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Essays on Public Education Expenditure, Trade Openness and Economic Growth of India

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Essays on Public Education Expenditure, Trade Openness and Economic Growth of India

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List of Abbreviations

2SLS	Two-stage Least Squares
ADF	Augmented Dickey–Fuller
AIC	Akaike Information Criteria
ARDL	Autoregressive-Distributed Lag
ASI	Annual Survey of Industries
BOP	Balance of Payments
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalized Method of Moments
GOI	Government of India
GSDP	Gross State Domestic Product
MHRD	Ministry of Human Resource Development
NIC-87	National Industrial Classification, 1987
NIC-98	National Industrial Classification, 1998
NSDP	Net State Domestic Product
INR	Indian Rupee
ISI	Import Substitution Industrialisation
IV	Instrumental Variable
OLS	Ordinary Least Squares
RBI	Reserve Bank of India
R&D	Research and Development
UEE	Universal Elementary Education
UN	United Nations
VAR	Vector Autoregression

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Declaration

I declare that I am the author of this thesis and that I have consulted all the references cited. All the work of which this thesis is a record has been done by myself and has not been previously submitted or accepted for a higher degree.

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Abstract

This study addresses some of the widely debated issues in the empirical education and trade literature in the context of India.

Chapter 3 examines the impact of public education expenditure and trade openness on economic growth of India using aggregate or country level data. The estimation results indicate that public education expenditure has a positive effect on growth but the impact is not very robust and sensitive to different estimation methods. The major contribution of this chapter to the existing literature has been to establish the dynamism in India's trade-growth nexus. The nature of the relationship between trade openness and economic growth of India has changed following the change in policy regime since the 1980s.

In Chapter 4, I investigate the trade-growth nexus further by employing disaggregated level analysis. Firstly, I disaggregate GDP by agriculture, manufacturing and services sectors and try to check which sector benefitted most from trade openness. Secondly, I try to assess whether trade openness affects manufacturing sector growth at the Indian state level. The latter analysis has been conducted using panel model analysis for 22 states. Econometric analysis indicates that the effect of trade openness has been heterogeneous across sectors. Only the services sector seemed to have reaped the benefits of increasing openness, so far. Consequently, no significant relationship could be found between agricultural sector performance and trade openness. It seems that the agricultural sector suffers from gross underinvestment and its performance still relies heavily on the monsoon cycles. At the country level, manufacturing sector failed to take advantage of the trade openness but the picture of stagnancy is not uniformly true when we look at the state-level manufacturing performance. I therefore re-estimate the relationship between state-level manufacturing

performance and state-level trade openness using state level data. The most notable contribution of this chapter to the existing literature has been the construction of trade openness indices for major Indian states. Overall, I find that there is a robust association between trade openness and manufacturing sector performance at the Indian state level. However, this relationship seems to be driven solely by the performance of the unregistered segment of Indian manufacturing.

In Chapter 5, I disaggregate the public education expenditure data by primary, secondary and tertiary sectors and examine the nature of the relationship between each sectoral expenditure and growth. None of the sectoral education expenditure had any impact on growth when the analysis is carried out for the entire time period 1951-2011. Both school and tertiary education expenditure started to exert a positive impact on Indian GDP growth once the country started to shift from a state-led growth model to a pro-business regime from the early 1980s. Finally, I examine the determinants of public education expenditure by the state governments using panel data for 16 Indian states. The economic variables such as NSDP per capita and tax revenue came out to be statistically significant indicating that richer states spend more on education compared to their poorer counterparts. States with smaller child population share (0-14 years, as percentage of total population) managed to allocate more funds towards education than those with larger shares. No significant evidence was found to suggest that political factors such as corruption and political ideology of the ruling party affect education spending decisions in Indian states.

Note on terminology on annual observations

All annual periods in this thesis are financial years, unless otherwise specified. For example, a period referred to in the thesis as 1980 to 2010 means 1980-81 to 2010-11. Similarly index numbers with a base year 1980=100 means an index with base year 1980-81=100. I use this style inter-changeably. But if I refer to any calendar year, I explicitly point it out.

Chapter 1: Introduction

This thesis addresses some of the widely debated issues in the empirical education and trade literature in the context of India.[1] It consists of three chapters attempting to answer some empirical questions, employing both aggregate and disaggregated level analyses. The introductory chapter sets out the motivation behind my research as well as the structure of the thesis.

1.1 Public education expenditure in India

Education has long been regarded as one of the prime drivers of economic growth. Over time, many human capital theories and growth theories have developed relating human capital and economic growth, thereby underlining the importance of education in the growth process. The existing literature contains a number of different conceptual rationales for the inclusion of human capital, both as stock and flow variables, in growth (Gemmell, 1996). For instance, Mankiw et al. (1992) extends the Solow Model where physical capital and human capital enter the production function as proportion of GDP. Romer (1990) postulates that productivity and, thereby, innovation is a function of the stock as well as the growth rate of human capital in an economy. In his model, growth is directly driven by physical capital investment which, in turn, is facilitated by investment in research and development (R&D). Thus, the Romer (1990) model suggests a role of both growth rate (flow) and stock of human capital in the process of economic growth. Human capital may also promote transfer of

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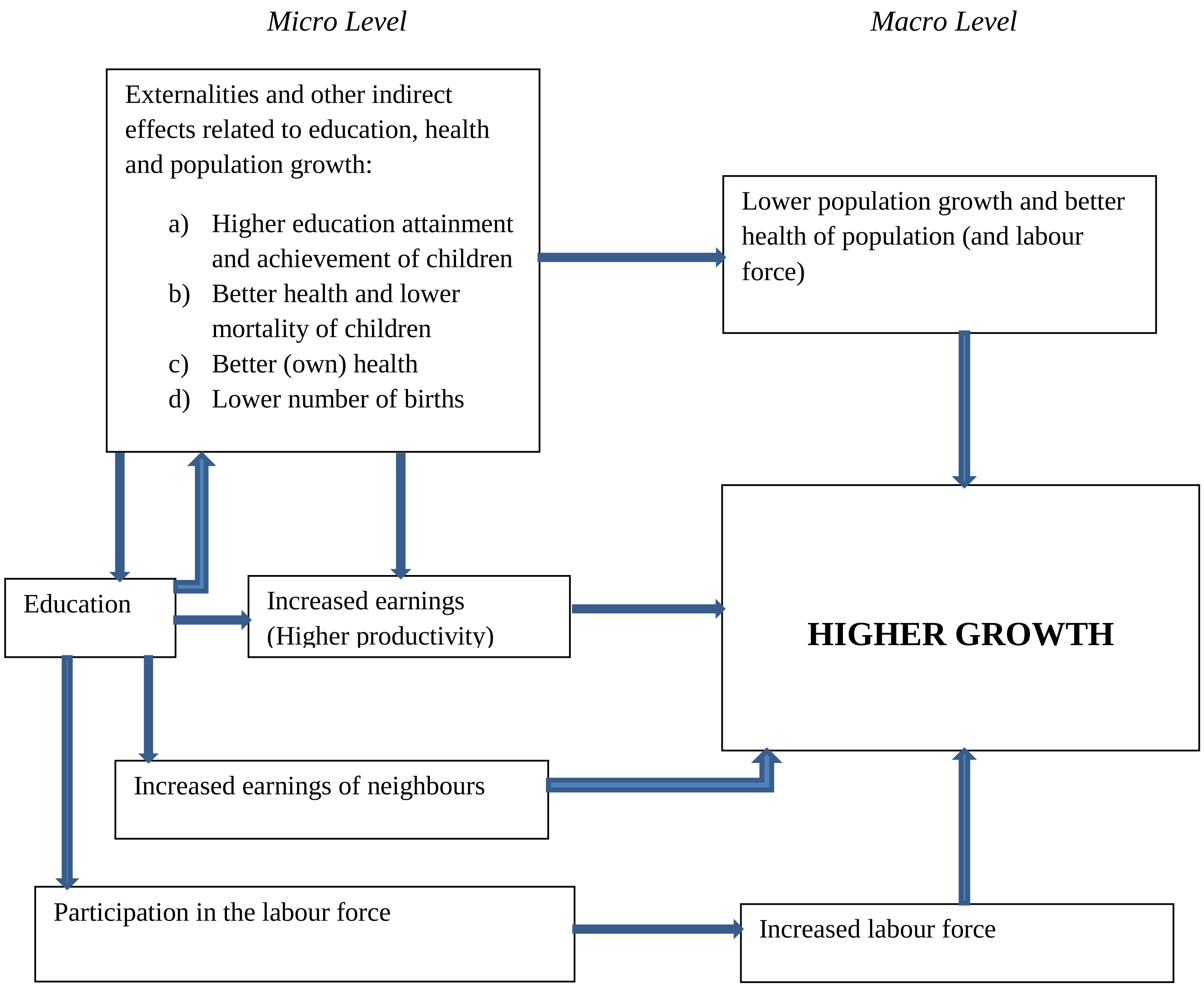
[1] The potential growth and developmental effects of public education expenditure trigger a lot of discussions in the media and the political circles. For instance, a Times of India article on 14th July 2014 regards education as a key driver of socio-economic development and argues for the need to raise the level of public expenditure on education in the 2014 Budget of the Central Government. Similarly, growth effects of education were acknowledged and the case for higher budgetary allocation towards education was advocated in a Hindustan Times report on 13th July 2014. The Human Resource Development (HRD) Minister of the current National Democratic Alliance (NDA) government in India, Smriti Irani, has also expressed the intention to increase the public expenditure on education to 6% of GDP from less than the current 4% in order to turn India into a 'knowledge hub' (Live Mint, 27th May 2014).
Similarly, the trade liberalisation programme undertaken by India since the beginning of 1990s has also triggered a lot of debates. Economists such as Jagdish Bhagwati and Arvind Panagariya strongly advocate the case for further liberalisation and, on the other hand, there are other eminent scholars, like Jean Drèze and Amartya Sen, who are skeptical about the developmental effects of those liberalisation measures (Project Syndicate, 23rd June 2011; Prospect, 15th July 2013).

technology from innovating to 'imitating' countries. According to Barro (1991), a technologically backward country will be able to absorb new technology faster than other comparable countries if it has a larger stock of educated workers. Thus, Barro predicts a role of the stock of the human capital where an initial higher level of the stock is associated a faster economic growth. [2]

Hypothetically speaking, there are many channels through which government's education spending can facilitate human capital accumulation and, in turn, promote higher economic growth. For instance, education expenditure leads to an increase in human capital which, in turn, increases the quality of labour and enhances the productivity of the labour force and thus accelerates economic growth (Chuang, 2000). Furthermore, expenditure on education leads to higher education attainment, better health, lower mortality of children and lower number of birth. All these factors subsequently cause higher productivity in terms of increased earnings and more participation in the labour force. This coupled with lower population growth and better health of population affects economic growth positively (Michaelowa, 2000). Figure 1.1 below presents an overview of the different channels through which education can affect economic growth.

[2] See Gemmell (1996) for a detailed discussion.

Figure 1.1: Linkages between Education and Growth

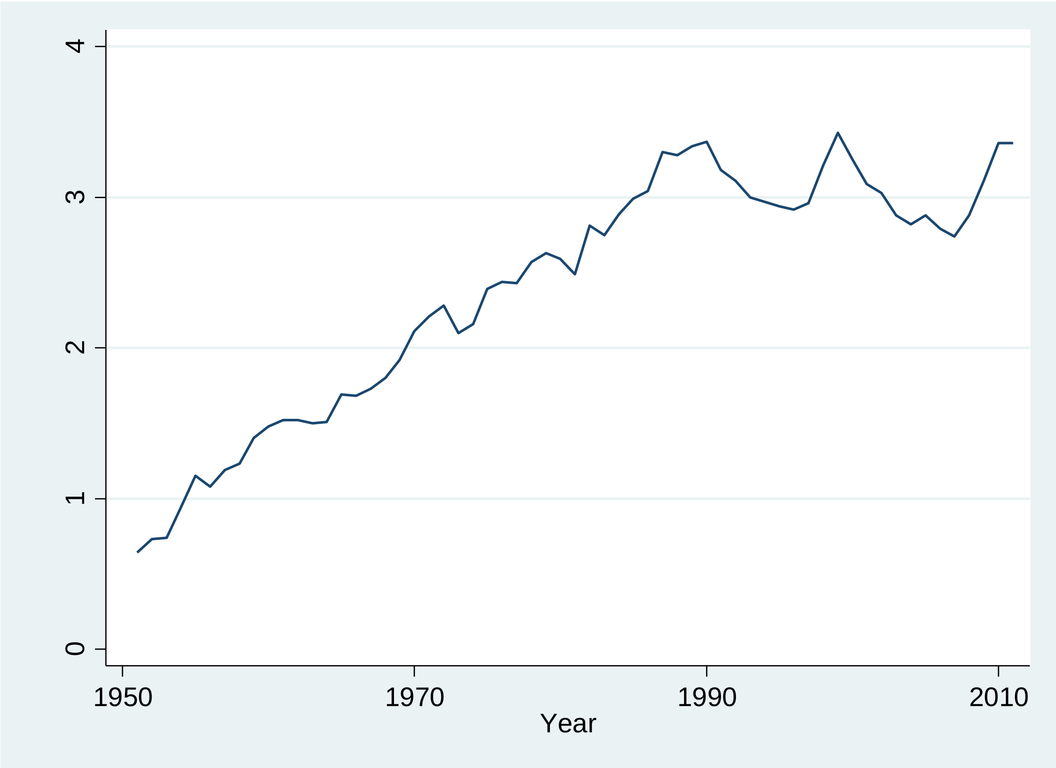


Source: Michaelowa (2000)

The Government of India acknowledged the role of education in development immediately after independence (Tilak, 2005). Education was made an integral part of development planning from the very first five year plan (1951-56). The quantitative expansion of the Indian education sector has been overall impressive. The expenditure share in GDP started off at 0.64% in 1951 and slowly rose to 3.36% in 2011. On the recommendation of the

Education Commission (1966), the Government of India had aimed to invest 6% of national income in education by 1986 (Tilak, 2007). That goal, however, has not been met yet.[3]

Figure 1.2: Aggregate Public Education Expenditure as percentage of GDP



Source: Analysis of Budgeted Expenditure on Education (various years), MHRD, GOI.

As seen in Figure 1.2, aggregate expenditure in education has been slowly but steadily rising in India. Yet, the empirical literature on India remains largely inconclusive on the growth effects of aggregate public spending on education. Some studies report that the effect is marginal whereas some even find it to be non-existent (see, for example, Nalla-Gounden, 1967; Ansari and Singh, 1997; Bosworth et al. 2007 and Pradhan, 2009, among others). In this context, I examine the empirical relationship between aggregate public education

[3] When compared to the OECD countries, India's performance has been quite dismal. In 2011, OECD countries spent an average of 6.1% of their GDP on educational institutions (OECD, Education at a Glance 2014). Even when compared to more similar countries in terms of the stage of economic development (for example, BRICS countries), India's performance has been average at best. The expenditure level roughly matches that of China (3.3% in 2009) but lags behind all the other BRICS nations. Russia spent 4.9% of GDP on education in 2010 (OECD, Education at a Glance 2013) whereas Brazil and South Africa spent 5.8% and 5.9% respectively (WDI, 2014).

expenditure and economic growth of India using time series econometric methods in Chapter 3. My contribution to the existing literature will be to analyse the impact of both public education spending and trade openness on India's economic performance in a single empirical framework. To my knowledge, this has not been done before previously for India. Most previous studies on India have attempted to estimate a gross relationship between public expenditure on education and economic growth ignoring the other potential growth determinants including trade openness. Similarly, most Indian studies examining the trade-growth link ignore the potential education expenditure (or human capital) effect on GDP and estimate a model omitting this factor. I believe that this study is one of the first to take both these factors into account in the estimating model. The theoretical framework comes from the Augmented Solow Model, proposed by Mankiw et al. (1992), which has been discussed in detail in Chapter 3.

A voluminous literature exists for India which tries to examine the relationship between enrolment ratio in different education sectors (such as, primary, secondary and tertiary sectors) or sectoral rate of return and economic growth (see, for example, Harberger, 1965; Tilak, 1990; Self and Grabowski, 2004; Mathur and Mamgain, 2004 and Haldar and Mallik, 2010 among others). But, there is virtually no existing study which attempts to assess the empirical relationship between sectoral public education expenditure and economic growth of India. This thesis makes a contribution to the literature by making a modest attempt to fill this gap in the literature in Chapter 5 (sub-chapter 5.1). Doing such an exercise shall enable us to understand the relative importance of each education sector in the growth process. If it is found that public expenditure is not having the desired effect in a particular sector then a raise in the budget for that sector could be recommended. The reasons behind this argument are two-fold. Firstly, the level of public education expenditure in India is inadequate and the government needs to attach more importance towards education (see, for example, Forbes

India, 2013; New York Times, 2013; Times of India, 2014; Hindustan Times, 2014; Ghosh, 2014 among others). Secondly, one may argue that if the public expenditure is not being effective in a particular sector then why the private sector is not encouraged to increase participation instead of the government. The private sector has been expanding in India quite rapidly during the post-reform period with 29% of aggregate student enrolment in the age 6-14 group in 2014 (The Hindu, 2014). Out of all primary level schools, 27% are private (MOSPI, 2010). I do not disagree with the case of further privatisation of the education sector but the government has to still play an active role in India. That is because the private sector operates for profits and they are not expected to open schools or colleges in economically backward areas. Being a developing country, India has millions of underprivileged who cannot afford the higher fees of private education (Patel, 2009). So, it has to be the responsibility of the government to ensure universal access to education. Hence, this study will also indirectly contribute to the ongoing public vs private sector investment debate in Indian education sector.[4] Finally, if the lack of effect is because of misallocation of resources then administrative or institutional reforms should be advocated so that the allocated budget to that sector is better monitored.

In this attempt, I try to estimate the relationship between public primary, secondary and tertiary education expenditure and economic growth using time series econometric methods for the time period 1951-2011 in sub-chapter 5.1. The econometric analysis conducted in 5.1 indicates that public education expenditure has a positive and significant impact on economic

[4] I also wanted to perform a comparative analysis of the growth-enhancing effects of public and private expenditures in education. But, this could not be done because of lack of long time series data for the private sector. However, I suspect that there is a very high chance of the presence of a reverse causality from GDP growth towards growth of private education expenditure because it could be argued that, unlike public investment, private investment in the education is an economic good and people have to pay for it. So, as Indian economy started to experience a faster growth since the 1990s more and more people started moving up the income ladder and consequently there were more consumers in the private education market demanding enrolment of their children in private schools, mainly because of the deplorable condition of many, if not most, public schools. A 2013 article by the Economic Times says that education has witnessed one of the fastest growth rates among different expenditure heads of Indian households and the household budget share of education increased from 2% to 7% between 1993-94 and 2011-12.

growth in the case of India. Thus, from a policy point of view, it may probably be asserted that public education expenditure is essential for India’s growth and, naturally, a higher allocation of funds towards education will be recommended. However, for that to materialise, we need to identify the factors that determine the level of education expenditure in India. If we look at the state level expenditure data, we will observe that education spending varies significantly across Indian states with some states spending considerably more than the others (discussed in detail in Chapter 5.2). Consequently, a natural extension of the research would be to examine the determinants of public education expenditure in India. This study has been conducted in Chapter 5.2 using Indian state level data because bulk of the public education expenditure is carried out by the state governments and, hence, a country level analysis may miss the dynamics at work at the state level. Moreover, the relative standing of states on the basis of per capita education expenditure has remained roughly the same over the last decade. So I ask in this exercise (Chapter 5.2): what determines the level of education spending by Indian state governments? To the best of my knowledge, there is only one study (Chakrabarti and Joglekar, 2006) which does a similar exercise. However, I believe that the present study stands out in many different aspects: a) the econometric analysis is more rigorous, employs Instrumental Variable (IV) and Mundlak (1978) techniques and takes better care of any potential endogeneity or reverse causality bias; b) I take political and institutional variables (such as corruption and political ideology of the ruling party) into consideration; and c) I work with a more recent time period.

1.2 Trade openness of India

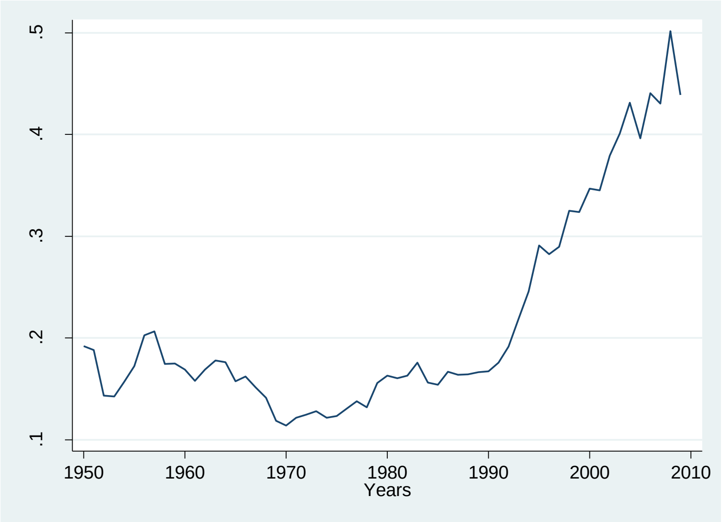
Broadly speaking, there are three sources of economic growth- factor accumulation, increase in productivity and innovation (Srinivasan, 2001). Trade openness can potentially enhance the growth prospects of a country by influencing any of these three sources of growth. For instance, an open economy can obtain factors (or their services) more easily from abroad compared to a closed economy. Trade openness also leads to better allocation of resources. When an economy opens up, forces of comparative advantage forces the economy to specialize in the sector for which it has better factor endowments. As a result, productivity of that sector goes up. The exports from that sector also increase which consequently boosts growth. Lastly, trade openness also encourages technology transfer from developed to developing economies which leads to an increase in factor productivity and finally enhances growth (Romer, 1990 and Chuang, 2000).

India had a relatively open trade regime until the 1950s with low tariff rates; quantitative import restrictions were not onerous and there was no evidence of foreign-exchange controls. The foreign exchange crisis in 1957 led to imposition of quantitative restrictions on imports, industrial licensing and foreign exchange controls, and these were progressively increased until 1966. The Ministry of Finance prioritised the usage of available foreign exchange. The foreign exchange requirements for debt repayment, embassy expenditures, food, fertilizer, petroleum, oil and lubricant (POL) were first met and after that allocations were made for private sector imports of raw materials and machinery. An array of licensing agencies was involved in the allocation process of foreign exchange. Imports of raw materials were not permitted if domestic substitutes were available (Panagariya, 2003).

The Government of India introduced export subsidisation schemes in 1962 but they were not very successful in boosting exports. One of the disadvantages of the requirement that domestically produced inputs be used when available was that Indian exporters were compelled to use inferior-quality domestic inputs and therefore could not compete with their international counterparts.

India went through a phase of economic liberalisation during 1966-68 which included measures such as the devaluation of the rupee by 57.5%, removal of some import licensing controls and cuts in import tariffs. The measures were unpopular because of the widespread belief that they were in response to the dictates of the World Bank and the liberalisation process was soon reversed and the protectionist regime continued until the 1970s (Panagariya, 2004). As seen in Figure 1.3, India's trade share (as percentage of GDP) went on falling continuously from late 1950s till 1970.

Figure 1.3: Trade openness of India, 1950-2010



Source: Penn World Table 7.0.
Note: Trade Openness is defined as exports plus imports as percentage of GDP (at 2005 constant prices).

India undertook several liberalising steps such as partial liberalisation of imports during the 1980s mainly to allow a more liberal flow of essential raw materials and machinery. It also expanded domestic demand through fiscal stimuli supported by large deficits. Consequently, India achieved a growth rate of above 5% during the 1980s, though it also increased its foreign and domestic debt to unsustainable levels. The result was a major macroeconomic crisis in 1991, which prompted serious economic reforms including a systematic liberalisation of trade. Within a decade, import licensing was entirely abolished and the highest tariff rate was brought down from 355% to about 30% (Bhat, 2011 and Mukherjee and Mukherjee, 2012). Consequently, India experienced a sharp rise in its trade openness.

There exists a large literature which tries to examine the empirical relationship between trade openness and economic growth of India. However, most studies employ panel model analysis using a cross-section of countries; time series works are relatively rare. One major disadvantage of panel model analysis is that running a regression with the same control variables for a multiple of countries does not provide an accurate picture because it does not take the peculiarities of individual countries under consideration. Such ‘general’ results cannot be used to provide a policy prescription for a particular country. In that respect, time series studies provide better insight (Sarkar, 2007 and Marelli and Signorelli, 2011). The findings of the existing studies, which assess the relationship between trade and growth of India using time series methods, are mixed (see, for example, Sarkar and Bhattacharyya, 2005; Sarkar, 2005; Mallick, 2008 andMarelli and Signorelli, 2011, among others). Many of the existing studies even conclude that trade openness has no or negative impact on growth. In this context, I examine the relationship between the two variables in Chapter 3 for the time period 1970-2010. All the past studies tried to estimate a static relationship between trade openness and economic growth of India by ignoring the regime change of the Indian economy. My analysis demonstrates that the relationship has evolved over time following the regime change in the early 1980s when the Indian economy started to move from a state-led growth model to a pro-market regime. Therefore, any assumption of a static trade-growth nexus, as done by past studies, may lead to inaccurate findings.

Next, I investigate the trade-growth nexus further by using disaggregated level data. The study has been conducted using two levels of disaggregated data. Firstly, I analyse the empirical relationship between sectoral GDP and sectoral trade openness in Chapter 4.1. The motivation for doing this exercise comes from the fact that once India started to undertake economic reforms after 1980, the growth performance of different economic sectors (namely, agriculture, manufacturing and services) has varied markedly. For instance, share of agricultural GDP has declined over time in total GDP, manufacturing sector share stayed more or less constant and that of services sector rose rapidly (see detailed discussion in Section 4.1.1). In view of that, the services sector has often been regarded as the engine of the India's economic growth during the post-liberalisation period and manufacturing and agriculture are said to have not been able to take advantage of India's increasing trade openness. The study aims to examine this hypothesis by investigating the empirical relationship between sectoral GDP and trade liberalisation (measured as trade openness) of India.

Finally, I examine the link between manufacturing sector growth and trade openness at the Indian state level in Chapter 4.2. There is no international trade data available at the Indian state level. Consequently, there exists no analysis of the impact of trade liberalisation at the state level (Marjit et al., 2007). That in itself was a motivation to extend the research in this direction. The contribution of this exercise has been the construction of trade openness index for Indian states. This is one of the first studies to examine the manufacturing growth-trade nexus at the Indian state level. Similar analysis could not be undertaken for state level agriculture and services sectors because of data constraints.

The rest of the thesis is structured as follows. Chapter 2 discusses the econometric methods and trade openness indices used in this study as well as the importance of disaggregated level analysis in the Indian context. Chapter 3 involves empirical examination of the impact of public education expenditure and trade openness on economic growth of India using aggregate level data. Chapter 4 revisits the trade-growth nexus using sectoral and state level data. Chapter 5 examines the growth effects of sectoral education expenditure on growth and also attempts to assess the determinants of public education expenditure using state level data. Chapter 6 concludes with policy implications.

Chapter 2: Measurement and Methodology

An attempt has been made in this thesis to identify the nature of the empirical relationship between public education expenditure, trade openness and economic growth of India. To do so, I have used data at the aggregate level (or, country level), sectoral level (i.e. by disaggregation of GDP into agriculture, manufacturing and services or by disaggregation of public education expenditure into primary, secondary and tertiary level) and state level (i.e. disaggregation by Indian states). Various measures of trade openness have also been employed to understand the trade-growth association in the Indian case. The aim of this chapter is to explain the rationale behind the usage of different proxies of trade openness and different data levels. I also seek to explain the appropriateness of the econometric methods which have been applied in the following empirical analyses. However, for the convenience of the reader, some of the explanations spelt out in this chapter have been purposefully repeated later, albeit briefly, in the following chapters for reminder purpose.

2.1 Why disaggregation matters in India's case? [5]

Chapter 3 involves examination of the empirical relationship between public education expenditure and economic growth and that between trade openness and growth using aggregate or country level data. The reason behind doing the country level analysis is that majority of the past studies in these areas has used aggregate level data. However, one major caveat of using aggregate level data is that it does not take the heterogeneity at the local or state levels into consideration. Moreover, if the relationships vary across states and across sectors then it is quite likely that an aggregate level analysis may produce misleading findings. Both in terms of spending on per capita education and level of trade openness, the performance of the Indian states have been quite heterogeneous (see Tables 4.14 and 5.16).

[5] For description of data sources, see the Appendices after chapters 3-5.

For instance, some states such as Himachal Pradesh and Haryana were spending INR 2314.4 and INR 1543.6 on per capita education in 2010-11. In the same year, Bihar and Madhya Pradesh had spent a meagre INR 625.9 and INR 621.4 respectively. Similarly, the extent of trade openness also differs drastically across Indian states with some such as Maharashtra and Tamil Nadu being much more ‘open’ compared to others such as West Bengal and Bihar.

Similarly, there are reasons to believe that there is heterogeneity in performance across sectors too. Firstly, in the context of trade openness, the performance of the three sectors, namely agriculture, manufacturing and services, vary markedly. Once the Indian economy started to gradually shift from a state-led growth model to a pro-business regime since the 1980s, the share of agriculture in aggregate GDP has declined, the manufacturing share has remained more or less stagnant and the services share has increased steadily (see Table 4.1). Even in terms of growth rate, the services sector has outpaced the other two sectors and has contributed to the two-third of the GDP growth during the post-reform period (Gupta and Kumar, 2010). It is therefore very likely that the effect of trade openness may vary across different sectors. If it is indeed the case that trade openness has positively affected one sector and negatively the other then analysis of this effect at the aggregate level may not reflect the true picture. Similar argument can be given in the case of public education expenditure too. Broadly speaking, there are three sectors of education, namely primary, secondary and tertiary sectors. There is ample empirical evidence to suggest that the growth effects vary significantly across these different education sectors (see the detailed review of this literature in Chapter 5.1).

Consequently, I argue that a disaggregated level analysis is likely to be helpful in case of India. In Chapter 4.1, I disaggregate the GDP data by sector (agriculture, manufacturing and services) and try to examine which of these sectors benefitted from trade openness. I then try to examine the trade-manufacturing growth nexus at the Indian state level. This analysis was only restricted to the manufacturing sector because, firstly, the trade reforms were undertaken to specifically boost the manufacturing sector (Gupta et al., 2008 and Banga, 2014) yet the analysis carried out in Chapter 4.1 reveals that the sector, at an aggregate level, failed to take advantage of the reforms. However, if we look at the state level data, we will see considerable heterogeneity in performance with some states experiencing remarkable growth in the manufacturing sector. For instance, the national average growth rate of the manufacturing sector during 2000-09 was about 8.5% but states such as Gujarat, Karnataka and Orissa registered 9.41%, 10.94% and 14.36% growth in manufacturing during the same time period. Furthermore, there are two sub-sectors within the manufacturing-the registered and the unregistered sectors-which are characteristically very different.[6] Hence, I examine the relationship between manufacturing sector performance and trade openness using state level data in Chapter 4.2. I have further disaggregated the manufacturing gross state domestic product (GSDP) into registered and unregistered sectors and re-examined the relationship at the state level. Secondly, state level trade data are not available for most states in India so I have constructed proxies for each state in my sample using industry level data from the Annual Survey of Industries database (ASI). Unfortunately, such comprehensive database does not exist for the other two sectors at the state level.

In Chapter 5.1, I disaggregate the public education expenditure data by sectors (i.e. by primary, secondary and tertiary sectors) and try to assess which sectoral expenditure affects India’s GDP growth positively. Finally, I try to examine the determinants of public education expenditure. This study is conducted using state level data because bulk of public education spending is financed by state governments. For instance, the states’ share of spending was 77.8% in the entire public expenditure on education in 2010 (see Table 5.15). The rationale

[6] All factories that employ more than ten workers with the aid of power and more than twenty workers without the aid of power are classified under registered (or, organised) manufacturing sector. All other manufacturing activities are classified under unregistered (or, unorganised) sector. The latter does not come under the purview of the labour laws or regulations (Besley and Burgess, 2004).

behind doing this study comes from the observation that the level of education spending varies significantly across Indian states. A review of the existing literature reveals that there are both economic and non-economic factors which determine the level of spending. Virtually no econometric study exists which tries to identify the non-economic factors for India. Hence, this study aims to add to the literature in this direction.

2.2 Use of trade openness measures

There is no consensus on how to measure trade openness (Das, 2003). Openness is neither directly observable nor is there a generally accepted measure (either theoretically or empirically). The measures can be broadly classified into two categories-trade volume and trade barriers. The most generally accepted measure is total trade share as percentage of GDP (classified under the trade volume group). Most empirical papers on India have used this measure as a proxy for trade openness (see the literature review in Chapter 3.1). In fact, one major shortcomings of the existing trade literature on India is that most studies have only used measures of trade volume and, to the best of my knowledge, no study employed any measure of trade barriers. Hence, I use measures of both trade volumes (import penetration ratio and total trade share as percentage of GDP) and trade barriers (Total taxes on International Trade as percentage of revenue and KOF Economic Globalisation Index) to estimate the relationship between trade openness and economic growth in Chapter 3.1.

In Chapter 4.1, the trade openness measures alter slightly because of the nature of the data. When estimating the relationship between agricultural GDP and trade openness, I have used agricultural trade share as percentage of aggregate GDP. That is because this measure precisely reflects the level of openness of the agricultural sector in relation to the entire economy. Using the aggregate trade share as percentage of GDP could be misleading in this case because total trade share is influenced by manufacturing and services too and hence may lead to misleading conclusions. Similarly, for the manufacturing and the services sectors, I use manufacturing trade as percentage of aggregate GDP and trade in services as percentage of aggregate GDP respectively. The other two measures of trade openness used in the analysis of Chapter 3 also could not be used in this chapter because KOF Globalisation Index and Total taxes on International Trade as percentage of revenue are country level measures.

In Chapter 4.2, I estimate the relationship between manufacturing sector performance and trade openness using state level data. As mentioned previously, state level trade data is not available for most states and therefore I construct proxies for state-level trade openness (both trade volume and trade barriers) using ASI data (see Chapter 4.2 for a detailed discussion on how these indices are constructed). The ASI gives data on production in different manufacturing sub-sectors for each state.

2.3 Discussion of Econometric Methods used

Depending on the nature of the data, various econometric methods have been employed to examine the relationship between public education expenditure, trade openness and economic growth. In Chapter 3, I first employ the augmented Dickey Fuller (ADF) test to determine the order of integration of the variables in my econometric model. Since the aforesaid three variables came out to be of the same order of integration so I initially wanted to check whether there exists any long run relationship between the variables. However, the Johansen test of cointegration indicated that there is no such relationship. Hence, I estimated the short run relationship between them using Ordinary Least Squares (OLS) method. The OLS model with KOF Globalisation Index as the trade openness index suffers from the problem of autocorrelation and so I re-estimated the model using Generalised Least Squares (GLS) method (Prais-Wisnten Regression). There is ample empirical evidence to suggest that there may be reverse causality running from economic growth towards trade openness or public education expenditure (see Chapter 3.1 for a detailed discussion on the relevant literature). If that is the case in India too, then the OLS and Prais-Winsten estimates will be potentially biased because of endogeneity issue. Hence, I re-estimated my econometric model using the Vector Autoregression (VAR) method which assumes that all variables are potentially endogenous. The ADF test indicates that most of the variables in my model are I(1) so I use the growth rates of all the variables in the OLS and VAR estimation to ensure that only stationary variables enter the model. My estimating model therefore becomes a growth model where I am examining whether increase in the growth rate of trade openness induces an acceleration of India's economic growth rate and, similarly, whether an increase in the growth rate of public education expenditure leads to an increase in the country's economic growth rate.

In Chapter 4.1, I follow the procedure similar to that in Chapter 3. I start by checking the stationarity of the variables in my model using ADF test. Since most variables came out to be I(1) I once again estimate my model using OLS and Prais-Winsten regression methods (in case of autocorrelation) and then re-esimtate using the VAR method to control for any potential endogeneity issues. Chapter 4.2 involves examination of the empirical relationship between manufacturing sector performance and trade openness using state level data. Here, the data is two-dimensional since both 'n' (number of states) and 't' (number of years used in the analysis) are greater than 1 and therefore I use panel model analysis to estimate the relationship. I use fixed effects model instead of random effects model in order to control for any potential time-invariant state-specific characteristics. I then re-estimated the model using Feasible Generalised Least Squares Method (FGLS) because there were problems of autocorrelation.

In line with the sectoral level study in Chapter 4.1, I employ a similar procedure to estimate the relationship between sectoral education expenditure and growth in Chapter 5.1. OLS and Prais-Winsten regression methods (when autocorrelation is detected in OLS results) and VAR are used. Furthermore, I have re-estimated the equation with primary education expenditure by Instrumental Variable Generalized Method of Moments (GMM) method because there was some evidence of reverse causality from growth towards primary education expenditure. In Chapter 5.2, I start by checking whether Random Effects model (REM) or Fixed Effects model (FEM) should be used. The Hausman test ruled in favour of the FEM. But the problem of first order autocorrelation was detected in the FEM estimation results so I re-estimate the model using Feasible Generalized Least Squares (FGLS) method. However, there can be potential reverse causality bias in our FGLS results if there is a causality running from state education expenditure towards economic growth. So, I also estimate an Instrumental Variable Regression using two-stage least squares (2SLS) method to control for the potential reverse causality. However, a major drawback of these methods (FEM, FGLS and IV 2SLS) is that we could not include controls for demographic characteristics and corruption in our model. That is because data on these two variables were available only for 1 year as data on former comes from Census of India which is conducted once every ten years and state level corruption data was only available from a Transparency International study(TI-CMS Corruption study)for the year 2005. I still wanted to control for these two variables as there is ample international evidence that corruption and demographics may influence the level of developmental expenditure of a government (see Chapter 5.2 for a detailed review of this literature). The only way that these two variables could be included in my econometric model was by assuming that these are time invariant variables. This assumption will not be so unrealistic in the context of my analysis since the time period under considered for this study is just ten years. Factors such as demographic characteristics and level of corruption take time to change significantly and hence it could be safely assumed that the demographic features and the relative ranking on the basis on corruption will stay more or less the same for the states over a span of a decade (ten years). However, with such time invariant variables in the model, the fixed effects method becomes ineffective. The random effects model also could not be used because it assumes that the individual (or, time invariant) effects are uncorrelated with other explanatory variables. If that assumption is not met, the estimator becomes inconsistent. So, I re-estimated the model using the Mundlak approach (Mundlak, 1978) in which the group means of the independent variables (which vary within groups) are added to the model (see Section 5.2.3 for a description of the model).

Chapter 3: Relationship between public education expenditure, trade openness and economic growth of India: Analysis at the Aggregate Level

3.1 Introduction

3.1.1 Education and Economic Growth

Education has been regarded as one of the leading determinants of economic growth since the time of Adam Smith. Over time, many economic growth theories and models (such as Romer, 1990 and Lucas, 1988) have developed relating education and economic growth. The belief, that education promotes growth has led governments of many developing countries to invest in the education sector. Even the theoretical literature provides a backing for such a policy (Pissarides, 2000). For example, education expenditure leads to human capital accumulation which in turn, increases the quality of labour and enhances the productivity of the labour force (via adoption or invention of new technologies) and thus accelerates economic growth (Chuang, 2000). Furthermore, expenditure on education leads to higher education attainment, better health, lower mortality of children and lower number of birth. All these factors subsequently cause higher productivity in terms of increased earnings and more participation in the labour force. This coupled with lower population growth and better health of population affects economic growth positively (Michaelowa, 2000).[7] Some researchers opine that India's major success in the software industry in the last decade is largely due to the major investments made in the technical education in 1950s and 60s (Chandra, 2010). However, thus far, no robust empirical relation could be established between the two variables in case of India (see the discussion in Section 3.2).

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[7] One may ask in this context that why should the government invest in education and why not the private sector. Nowhere has it been implied in the thesis that the private sector should not invest in the education sector. But, private schools are expected to operate for profits and will not open in economically backward areas of the country. Hence, in a developing country like India where 24.5% of the population lived below the poverty line in 2011 (WDI 2012, where poverty line is defined as $1.25 a day), it is the government which has to ensure access to education for all.

3.1.2 Trade Openness and Economic Growth

The relationship between trade openness and economic growth is widely debated in the growth and development literature. In general, there is optimism among most economic policy planners in favour of trade openness (see, for example, Deraniyagala et al. 2001, Yanikkaya, 2003, Sarkar, 2005 and Sarkar, 2008 among others). The primary reason for this is the failure of import-substituting industrialization (ISI) strategies adopted by many developing countries in the post Second World War period. The ISI strategy was based on the belief that poor countries will be exploited by rich countries in the international financial markets and trade. However, the strategy only led to misallocation of resources by encouraging growth of inefficient domestic firms. Moreover, the ISI policies favoured only a few powerful vested interest groups, powerful lobbies and specific political groups in many developing countries resulting in formation of monopolies and increased rent seeking activities (Balassa, 1971; Bhagwati, 1978 and Milner and Kubota, 2005).

In the late-1970s, many countries abandoned ISI strategy and adopted trade liberalisation measures. The High performance Asian economies (HPAEs) such as China, Hong Kong, Taiwan, Singapore and South Korea adopted a strategy of Export-oriented Industrialisation and experienced rapid economic growth. The success of such policies was hailed by international organisations such as the International Monetary Fund and the World Bank. The World Development Reports (World Bank 1987, 1991, 1999-2000) highlight that "outward oriented countries" performed better than "inward oriented countries" even under unfavourable market conditions. However, the theoretical considerations and the empirical evidence whether trade openness accelerates growth is quite ambiguous.

In this context, I investigate the empirical relationship between public education expenditure, trade openness and economic growth of India. The motivation for doing this analysis comes from the fact that there exists virtually no study which analyses the joint effects of public education expenditure and trade openness on economic growth in the Indian context. The rest of the chapter is structured as follows. Section 3.2 reviews the relevant literature, Section 3.3 describes the econometric model used in the analysis as well as the theoretical framework on which the model is based, Section 3.4 presents and interprets the results and Section 3.5 concludes.

3.2 Literature Review

3.2.1 Public Education Expenditure-Growth Literature

The relationship between public education expenditure and economic growth is a frequently debated topic in both theoretical and empirical literature. [8] Importance of education in the growth process can trace back its validation to Adam Smith and Alfred Marshall. However, the early growth models like the Harrod–Domar model and neo-classical growth models regarded capital and labour as the sole determinants of economic growth. The theoretical foundation for the impact of education on economic growth was first built by the endogenous growth theories introduced by Romer (1990) and Lucas (1988). Lucas (1988) and Mankiw et al. (1992) argue that the accumulation of human capital would lead to an increase in the productivity of other factors through innovation and technological progress and thereby raise growth. In their models, a state's rate of growth depends on the rate of accumulation of human capital. Thus, the empirical literature trying to investigate the link between education expenditure (or, human capital accumulation in general) draws its theoretical basis from the endogenous growth theories.

Many empirical studies have tried to examine this relationship for India and have come up with varied findings. Nalla-Gounden (1967) shows that education expenditure are not very attractive forms of investment and its rate of return is very low compared to that of physical

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[8] There exists a large related literature on human capital accumulation and economic growth which work with enrolment ratio or average years of schooling as proxy for human capital. Given the scope of the thesis, I am discussing only those papers which work with public education expenditure.

capital. Although the paper makes no attempt to measure the contribution of education expenditure towards economic growth yet the importance of the paper lies in the fact that it was one of the earliest studies that assess the education policies of the Indian government at a time when India had a ‘limited resource base’. The Indian government started allocating considerable resources towards education immediately after independence (1.2% of national income in 1950 which increased to 2.9% by 1965) and the total spending on education increased at a rate which was more than twice the growth rate of national income during 1950-1965. This paper finds that the marginal productivity of physical capital is higher compared to that of education and suggests diversion of resources in favour of physical capital. Ansari and Singh (1997) use annual time series data from 1951 to 1987 to study the relationship between public spending on education and growth and do not find any long run relationship between them. Bosworth et al. (2007) investigate the major contributors to India’s economic growth during the time period 1960-2004. The paper examines which sector-agriculture, industry, and the services-has contributed the most in the growth process and what have been the driving factors such as increased employment, capital per worker and educational attainment. The authors conclude that education’s contribution has been negligible. Pradhan (2009) investigates the causality between public education spending and economic growth in India during 1951 to 2001 using Error Correction Modelling. The findings suggest that there is uni-directional causality between education and economic growth in the Indian economy. The direction of causality is from economic growth to education spending and not vice versa. Chandra (2010) tests for a causal relationship between education investments and economic growth for India for the time period 1951-2009 using linear and non-linear Granger causality methods. He finds that there is bi-directional causality between education spending and GDP for India. Tamang (2011) examines the relation using

Error Correction Modelling technique for the years 1980-2008 and finds that there exists a long-run relationship between education expenditure and growth.

Thus, it can be seen that the empirical evidence for India is quite mixed. I speculate that this may be because different studies have used different estimation procedures. Furthermore, the time period considered for analysis also varies from one study to the other.

3.2.2 Trade Openness-Growth Literature

The traditional models of international trade discuss how trade openness improves the allocation of resources thus leading to an increase in production. The Ricardian Model says that trade liberalisation makes an economy specialise in the sector where it has a comparative advantage.[9] This, in turn, leads to an increase in production of output and makes the country better off. The Heckscher-Ohlin Model shows that if two economies have different resources (i.e. one is more labour-intensive and the other more capital-intensive) then opening up to trade can lead to higher output (thus, higher incomes) in both the economies. That is because each economy specialises further in the sector which uses its abundant factor more intensively in the H-O model. In some "new" trade theories (such as Krugman, 1979) also, the total output goes up as a country liberalises its trade.

However, as per the growth theories, the impact of trade openness on the rate of economic growth is not very clear (Lopez, 2005). For example, in the neoclassical growth models such as the Solow model, the steady-state rate of output growth is exogenous. One explanation for why a change in policies (initiating trade reforms, for example) will not bring a change in the steady-state growth rate in the neoclassical models is because of the assumption that the marginal product of capital declines to zero as the capital-labour ratio increases

[9] **Comparative Advantage**: The ability of an economy to produce a particular good or service at a lower opportunity cost than other economies.

indefinitely.[10] The new growth theories or the endogenous growth theories do recognise trade openness as one of the primary engines of growth (Romer, 1990 and Lucas, 1988).[11] However, the new growth theories do not presume that trade openness will unambiguously promote economic growth (Harrison, 1991). When a closed economy opens up, the forces of comparative advantage can either promote primary sectors or technology and high-skill intensive sectors depending on the initial factor endowments of the economy. If an economy is technologically backward then trade liberalisation is most likely to encourage the economy to specialise further in primary or low-skilled sectors and discourage the development of its high-skilled sectors which may ultimately have an adverse effect on its long run growth rate (Grossman and Helpman, 1991).[12] Growth after trade liberalisation depends on whether the liberalisation is encouraging R&D and innovation or not. However, sometimes increased competition from trade liberalisation can discourage innovation by lowering expected profits.[13] On the other hand, protectionism can facilitate long-run growth if protectionism encourages investment in research-intensive sectors (Grossman and Helpman, 1992). Furthermore, whether trade openness will accelerate growth or not depends on a large number of other factors such as macroeconomic stability and investment in physical and social infrastructure (Panagariya, 2003). In short, the theoretical literature cannot provide an unambiguous answer to the question of trade and growth.

Several studies have analysed empirically the relationship between trade openness and growth. They can be broadly classified into two groups: cross-country studies and country-

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[10] Also, in the neoclassical growth models, technological change is exogenous and is thus unaffected by an economy's openness to trade.

[11] "New" growth theories say that trade policies may have an impact on the long run growth rate by its impact on technological change (Harrison, 1991). As mentioned previously, trade openness allows an economy to import inputs from foreign countries thus giving access to new technologies. Also, openness gives domestic producers access to new markets thus increasing the return to innovation which may motivate further technological advancement.

[12] This is because the growth of high-skilled sectors (such as high-technology manufacturing and services) generates externalities by way of promoting skills, R&D and innovation while that is not the case with the growth of primary sector.

[13] Increased competition may reduce the market share for each firm thus lowering their profits.

specific case studies. The cross-country literature is vast and the important papers are documented vividly in Edwards (1993), Baldwin (2003) and Winters (2004).[14] Many cross-country studies such as Dollar (1992), Sachs and Warner (1995), Edwards (1998) and Frankel and Romer (1999) have found that trade openness affects growth positively. However, these studies have been criticised by Rodriguez and Rodrik (2001) on the ground of flawed trade openness measures and “weak” econometrics. Given the scope of our paper, we do not enter into a detailed discussion of the shortcomings of these cross-country studies and, instead, choose to focus more on the time series studies concerning India.[15] Overall, the cross-country evidence on the relationship between trade openness and growth (proxied by both trade volume and trade barriers) remains inconclusive. The relationship is not very robust and is sensitive to different model specifications and to use of different openness indices (see Levine and Revelt, 1992 also).

Various World Development Reports (World Bank, 1991, 1999-2000) try to show that outward-oriented trade policies have been more successful than protectionist policies in generating growth. The transitional economies are generally always advised by the institutions such as World Bank and IMF to follow the policies of trade liberalisation (See Sarkar, 2008 and Rodriguez and Rodrik, 1999). However, some authors such as Singer (1987) question the validity of the World Development Reports. Many researchers (such as, Adkisson, 1998 and Went, 2000) are of the opinion that such “one-size-fit-for-all” policy prescription for developing countries ignores history, institutions and economic structures of these countries.

The empirical evidence for the connection between trade openness and economic growth for India is also quite ambiguous. Two main reasons for such ambiguity in findings can be

[14] For a discussion on the more recent studies, see Lopez (2005).
[15] For a detailed discussion on the shortcomings of the cross-country studies, see Rodriguez and Rodrik (2001), Winters (2004) and Hallak and Levinsohn (2004).

attributed to methodological shortcomings and inappropriate choice of trade openness indices.

Marelli and Signorelli (2011)[16] show that trade openness facilitates economic growth in India and China under a panel model set-up. However, doing a panel data analysis with India and China is a questionable methodological choice because India and China have quite different growth experiences. As Bosworth and Collins (2008) point out, China stands out for its remarkable growth in the industrial sector which was fuelled by its fast reduction in trade barriers and active encouragement for FDI inflows. On the other hand, India's rapid growth has been primarily due to the expansion of the service sector. In other words, the sources of growth in the two countries are quite different. Thus running a panel regression with the same control variables for the two countries does not provide an accurate picture because it does not take the peculiarities of individual countries under consideration. Such "general" results cannot be used to provide a policy prescription for a particular country. In this respect time-series analysis gives a much better insight (Sarkar, 2008). Even Marelli and Signorelli (2011) also admit that it is better to use a time-series approach if the characteristics of an individual country are to be addressed.

Sarkar (2008) employs time series analysis and finds that trade openness has negative impact on India's growth. This paper used exports and imports as percentage of GDP as proxies for openness. This choice of just one openness index is questionable because that index focuses only on trade volumes and not on trade policies. First of all, it should be acknowledged that the greatest challenge for the researchers in this field is to give a clear definition of "trade openness" (Yanikkaya, 2003). Different studies have used different measures for trade openness; some have focused on the absolute trade volumes whereas some have constructed openness indices based on trade barriers. However, using a proxy for only trade volume does

[16] This paper employs both time series and panel approach to estimate the relationship between trade openness and growth. The findings from the time series analysis are presented in Table 3.1.

not take into account different aspects of trade liberalisation. It may be the case that one country experiences a considerable increase in its trade volume long after it has adopted free trade policies in the form of tariff reduction measures. Hence, a more efficient approach will be to examine the impact of various measures of trade openness indices (including both measures of trade volumes and trade restrictions) on growth in order to get a more complete picture on the relationship between the two. Table 3.1 presents the findings of other time series studies on the relationship between trade openness and growth of India.

Table 3.1: Review of Literature on India

Paper/Study	**Trade Openness Indices used**	**Methodology**	**Findings**
Sahoo and Mathiyazhagan (2003)	Exports/GDP	Johansen co-integration test	Evidence of long run positive relationship between exports and GDP growth during the period 1979-2000.
Sarkar and Bhattacharyya (2005)	export/GDP, import/GDP and (exports+imports)/GDP	Autoregressive Distributive Lag Method (ARDL)	Evidence of "unfavourable" impact of trade liberalisation on real growth rates of India.
Sarkar (2005)	export/GDP, import/GDP and (exports+imports)/GDP	ARDL	No positive long-term relationship between opening up and growth of India during 1956-1999.
Mallick (2008)	exports+imports as % of GNP	Structural VAR	Trade openness has positive impact on growth.
Dash and Sharma (2008)		Engle and Granger two-step cointegration analysis	Trade has a positive impact on economic growth during the time period 1950-2007.
Marelli and Signorelli (2011)	exports+imports as % of GDP	2SLS	Openness has positive impact on economic growth during 1980-2007.

Thus it can be seen that the empirical evidence for India is quite mixed. Some studies find positive association between trade openness and growth whereas some find a negative relationship. It seems that the past Indian studies have only used trade shares (or, trade volume) as proxy for openness and have not considered any indicator of trade barriers.

3.3 Theoretical framework and Model Formulation

Most empirical studies of economic growth begin with the neoclassical model, originally proposed by Solow (1956) and extended by Mankiw et al. (1992) to include human capital. The Cobb-Douglas production function appears in the general form as:

$$Y(t)=A_tK_t^{\beta_1}H_t^{\beta_2}L_t^{\beta_3} \qquad (1)$$

where, $\beta_1+\beta_2+\beta_3=1$

with Y_t= Aggregate production of the economy at time t, A_t =Total factor productivity at time t, K_t= Physical capital stock at time t, L_t = Employed labour force at time t and H_t = Human capital stock at time t.

As per the economic theories on trade and growth we know that one of the channels through which trade openness affects GDP growth is via productivity growth. For example, Helpman and Krugman (1985) argue that exports may increase productivity by offering greater economies of scale. This view has found further support in the endogenous growth theories where trade promotes long-term economic growth through productivity spillovers and higher rate of technological innovations (see, for example, Romer, 1986 and Lucas, 1988). This theoretical assertion that trade promotes productivity growth has found vast empirical support too. Using a sample of 77 countries (which includes both highly industrialised countries and developing countries), Coe et al. (1997) show that trade enhances technology transfer. Wu (2000) decomposes the TFP growth into its following sub-categories-technological progress, technical efficiency and scale efficiency-and finds that trade openness affects the first two sub-categories positively for the APEC countries during the time period 1980-1987. Using data on 73 countries between 1960 and 1994, Isaksson (2001) argues that trade is a significant carrier of knowledge or technology (see Isakkson, 2007 and the references cited therein for a detailed review of the empirical literature which finds that trade promotes total factor productivity growth).

Hence, total factor productivity can be expressed as a function of trade openness and other exogenous factors C_t.

$A_t = f(T_t, C_t, e_{2t})$ (2)

or, $A_t = T_t^{\beta_4} C_t e_{2t}$ (3)

Where T_t = Trade openness at time t and e_{2t} = error term

Combining (3) and (1),

we get,

$Y_t = C_t K_t^{\beta_1} H_t^{\beta_2} L_t^{\beta_3} T_t^{\beta_4} e_{2t}$ (4)

where, β_1 = Elasticity of production with respect to K_t, β_2 = Elasticity of production with respect to human capital, β_3 = Elasticity of production with respect to labour force participation, β_4 = Elasticity of production with respect to trade openness.

Taking natural logs (Ln) on both sides of equation (4) gives an estimable linear function:

$\ln Y_t = \ln C_t + \beta_1 \ln K_t + \beta_2 \ln H_t + \beta_3 \ln L_t + \beta_4 \ln T_t + e_{3t}$ (5)

where, $\ln C_t$ is a constant parameter.

According to equation (5), an econometric model of the selected variables used in this study is given as:

$LGDP_t = \beta_0 + \beta_1 LPcapital_t + \beta_2 LEdexp_t + \beta_3 LLabour_t + \beta_4 LTrade_t + u_t$ (6)

where,

GDP= GDP at factor cost (constant 2004 prices, Rs billion),

PCapital= proxy for physical capital defined as gross capital formation as percentage of GDP (both in 2004 constant prices),

Edexp= Public education expenditure by the central government (constant 2004 prices, INR crore),[17]

Labour= size of labour force (in millions),

Trade=various trade openness indices discussed in subsection 3.3.1 and

u=error term[18]

Equation 6 has been estimated using time series econometric methods. The reason behind the use of time series approach has been the fact that the study solely focuses on a single country-India. As mentioned in the previous section, employing panel or cross-country regressions with multiple countries may not take the peculiarities of individual countries into consideration. Temple (1999) points out that cross-country studies have been the most popular approach in growth literature and many studies have previously tried to understand the determinants of growth by integrating developed and developing countries in a single empirical framework. Such an exercise is not without its problems because economic and production structures differ vastly across countries. That is why Harberger (1987) asks:

"*What do Thailand, the Dominican Republic, Zimbabwe, Greece, and Bolivia have in common that merits their being put in the same regression analysis?*"

Such 'general answers'[19] may not identify the country-specific drivers of growth and thus become unreliable for country-specific policy prescriptions. Levine and Renelt (1991) show

[17] 1 crore=10 million
[18] See Table A3.1 in the Appendix for data sources.

that almost all cross-country regression results are fragile and are sensitive to slight alterations in the list of explanatory variables.

However, there are some advantages of cross-country studies over time series analysis. As Greiner et al. (2005) point out, one advantage of cross-country studies is that one may use the average growth rate over a long time period which makes the effect of any structural break leading to different parameters less severe in comparison to time series studies. Secondly, it is easier to obtain data on several countries for a shorter time period than high-quality time series data on a single country for a longer time period. In response to the first point raised by the Greiner 2005 book, it can be said that the potential structural breaks in the Indian growth series has been identified and taken care of in all the time series analyses (Chapters 3, 4.1 and 5.1) conducted in this study to ensure that change in parameters do not influence the findings. As far as the length of time period is concerned, long time series data for India are easily available and therefore that was not an issue in this study.

Finally, the Mankiw, Romer and Weil model was developed for cross-country analysis and was based on steady state growth. So, one may question the relevance of this model (or, in general, of endogenous growth models) in the context of my empirical investigation. Firstly, it should be clarified that the empirical relationships that I examine in the study are all short-run relationships. In other words, the specifications of my estimating models are non-steady states because steady state specifications are not possible in case of a time series study, unless one have a very long time period (Rao, 2006). Hence, the relationships that my econometric analysis reveals should not be interpreted as long-run relationships. Another issue with the time series studies has been misspecification bias. Rao (2006) says that many studies include several institutional and political variables but ignore the need to include 'conditioning

[19]See Temple (1999) for a detailed discussion on the shortcomings of cross-sectional studies in the growth literature.

variables' such as capital and employment-the two basic inputs of production. The model used in this study does include these above-mentioned two variables and the Ramsey RESET Test confirms that there is no misspecification problem in the model.

3.3.1 Trade Openness Indices

There is no consensus on how to measure trade openness (Das, 2003). Openness is neither directly observable nor is there a generally accepted measure (either theoretically or empirically). As previously discussed, most empirical papers on India have used trade share as percentage of GDP as a measure of trade openness. One criticism of this measure is that it measures trade volume and not explicitly trade policy and that, trade share is actually the impact of trade liberalisation and is not really an indicator of the rate at which the country liberalises its trade. Furthermore, a country's trade volume is affected not only by trade policy but also by other factors such as country size, distance to trade partners, transportation costs and world demand.

Hence I attempt to capture different aspects of openness by using four different measures. By doing so, I believe that this study presents a more complete picture of the relationship between trade openness and growth of India as compared to some of the previous studies on India.

a) **Total Trade Share (Trade):** This is the most commonly used measure for trade openness in the empirical literature, defined as exports + imports as percentage of GDP.

b) **Import Penetration ratio (IPR):** This is a measure of trade intensity calculated as total imports as percentage of GDP.

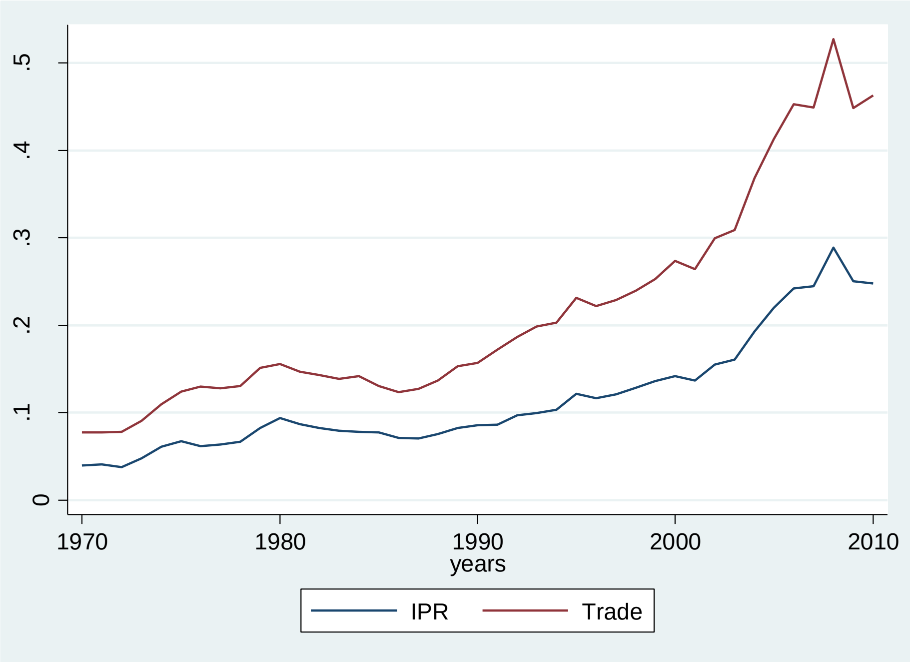
c) **Total Taxes on International Trade as percentage of revenue (Tax):** This is a measure of trade barriers which includes import duties, export duties, profits of export or import monopolies, exchange profits and exchange taxes.[20]

[20] Data is available from 1990 onwards only.

d) **KOFB:** I have chosen the fourth openness index from the KOF Economic Globalization Index. It has 2 dimensions-(i) economic flows such as trade and Foreign Direct Investment (FDI) and (ii) restrictions such as tariff barriers. Each variable has been transformed to an index on a scale of one to hundred (where hundred is the maximum value for a specific variable and one is the minimum value). Higher values denote greater globalisation. Our fourth index is based on (ii) and is explained below. I call it 'KOFB'. This index is based on restrictions consisting of hidden import barriers, mean tariff rate, taxes on International Trade (% of current revenue) and capital account restrictions with assigned weights 24%, 27%, 26 % and 23% respectively. The lower the restrictions a country has, the higher the rating it gets. So, KOFB is expected to be positively correlated with growth.

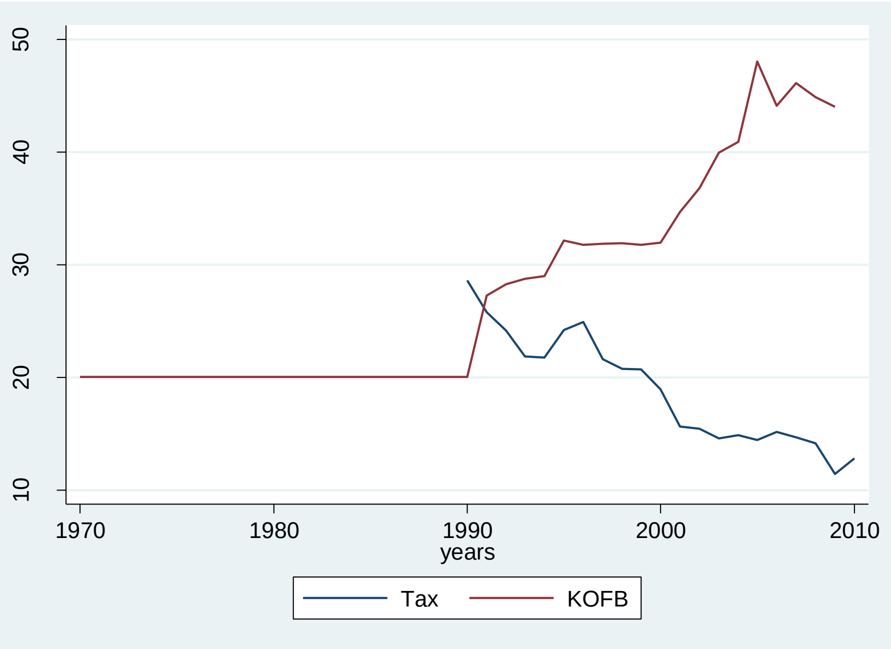
Figure 3.1 and Figure 3.2 present the measures of trade volume-'IPR' and 'Trade' and measures of trade restrictions-'Tax' and 'KOFB' respectively. As can been seen below, trade volumes started to rise steadily some time from the late 1980s. In the early 2000s, the rate of increase in both import volumes and total trade became even faster. Trade barriers simultaneously kept on declining 1990 onwards. As the data on KOFB suggests, the extent of globalisation remained fairly constant from 1970 till 1990. As India started to embrace trade reforms from 1991 onwards, the index kept on increasing which suggests of India's increased integration with the world economy over the last two decades. Similarly, taxes on international trade (Tax) exhibited a declining trend since 1990. Succinctly speaking, all these measures suggest that India's level of trade openness has increased significantly since the 1990s.

Figure 3.1: IPR and Trade, 1970-2010



Source: Author's own calculations based on data from WDI.

Figure 3.2: Tax and KOFB, 1970-2010



Source: Author's own calculations based on data from WDI. KOFB data has been obtained from KOF Index of Globalization, accessed at http://globalization.kof.ethz.ch.

The econometric analysis has been presented in the following section. All variables in my model are expressed in their natural logarithms except 'Pcapital' because its values lie between 0 and 1.

3.4 Results and Discussion

Before employing time series econometric techniques, we need to examine the stationarity of the variables to determine their order of integration. To do that, the Augmented Dickey Fuller (ADF) test has been used.

Let us consider the following model:

$y_t=\mu+\beta t+\alpha y_{t-1}+\varepsilon_t$

where, μ=constant, t=time trend and ε=error term.

We want to test the hypothesis of the existence of a unit root. The null and alternative hypotheses can be formulated as follows:-

H_0: $\alpha = 1$ (unit root)

H_1: $\alpha < 1$ (Integrated of order zero)

The equation above can be re-written as

$\Delta y_t=\mu+(\alpha-1)y_{t-1}+\beta t+\varepsilon_t$

or, $\Delta y_t=\mu+\emptyset y_{t-1}+\beta t+\varepsilon_t$

For this expression the hypothesis should be re- written as

H_0: $\emptyset= 0$ (unit root)

H_1: $\emptyset< 0$ (Integrated of order zero)

The Dickey-Fuller test presumes the existence of white noise errors in the regression. If that is not the case, the test will lose significant power. In order to deal with this issue, the test is employed as the Augmented Dickey Fuller test, in which a number of lags of the dependent variable are added to the regression to whiten the errors:

$$\Delta y_t=\mu+ \O y_{t-1}+ \Omega_1\Delta y_{t-1}+ \Omega_2\Delta y_{t-2} +\ldots..+\beta t+\varepsilon_t$$

Akaike Information criterion (AIC) has been used to determine the optimal number of lags for my model.

Table 3.2: ADF test results with trend and intercept

Variable	**Level**	**1st Difference**	**Conclusion**
LGDP	3.72	-7.61***	I(1)
Pcapital	-0.32	-10.09***	I(1)
LEdexp	-0.39	-6.54***	I(1)
LLabour	1.15	-2.75*	I(1)
LTrade	4.09**	-3.61***	I(1)
IPR	2.58	-6.35***	I(1)
LTax	-2.71*		I(0)
LKOFB	-2.00	-3.77**	I(1)

Note: The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of null hypothesis for ADF test is based on the MacKinnon critical values.
***, ** and * denote statistical significance at 1%, 5% and 10% respectively.

Since all the variables are of the same order of integration (except LTax) so I wanted to see whether any long run relationship exists between GDP, public education expenditure and trade opennss. Johansen cointegration test indicates that public education expenditure has no long run effect on GDP. Hence I do not report the results here. The test also indicates that trade openness has no long run effect on GDP. Hence, I try to estimate the short run relationship between these variables by initially using Ordinary Least Squares (OLS) method. Furthermore, the empirical evidence suggests that its not always the case that there is uni-directional causality running from education expenditures towards economic growth. It can be that economic growth affects spending on education (Pradhan, 2009). Similarly, there can be bi-directional causality between trade openness and growth (Tsen, 2006). If that is the case, then all the variables in our model will be essentially endogenous and OLS results will be biased. Hence I will also estimate our model employing Vector autoregression (VAR) method to examine the direction of causality between trade openness, education expenditure and growth. Since all the variables are I(1), so they are converted into their first differences to make them stationary. The model then basically transforms into a growth model where I am trying to examine whether an increase in the growth rate of public education expenditure and trade openness induces an acceleration in the GDP growth rate.

The OLS regression equation looks like the following:-

$$\Delta LGDP_t = \beta_0 + \beta_1 \Delta LGDP_{t-1} + \beta_2 \Delta Pcapital_t + \beta_3 \Delta LEdexp_t + \beta_4 \Delta LLabour_t + \beta_5 \Delta LTrade_t + u_t \qquad (7)$$

A lagged dependent variable has also been incorporated in the model. However, even if we do not control for the lagged dependent variable, our model does not suffer from the problem of autocorrelation. Different trade openness indices will enter the model separately and one at a time. Ramsey Reset Test shows that our model is correctly specified and there is no problem of autocorrelation, as evident from the Portmanteau Test results. The OLS estimation results are presented in the following table.

Table 3.3: OLS Estimation Results with Total Trade Share (Trade)

Independent Variable	Coefficient Time Period: 1960-2011	Coefficient Time Period: 1960-2011
$\Delta LGDP_{t-1}$		-0.31**
$\Delta Pcapital_t$	-0.001	0.07
$\Delta LEdexp_t$	0.14**	0.15***
$\Delta Llabour_t$	-0.51	-0.68
$\Delta Ltrade_t$	-0.06	-0.08*
Trend	0.001***	0.002***
Constant	-0.001	0.006
	R^2 =0.35 **Ramsey RESET test** H_0: No omitted variables P-value=0.93 **Portmanteau Test for White noise** H_0:No autocorrelation P-value=0.21	R^2 =0.42 **Ramsey RESET test** H_0: No omitted variables P-value=0.73 **Portmanteau Test for White noise** H_0: No autocorrelation P-value=0.19

Note: Dependent variable=$\Delta LGDP_t$. The errors are heteroskedasticity-robust standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1% respectively. A time trend has also been included in the model.

The OLS results indicate that the rate of increase in public education expenditure has a positive effect on GDP growth rate. The relationship between trade openness and growth is negative which is counterintuitive. However, the relationship is fragile and sensitive to different model specifications. The overall findings do not change even when we rerun the model using different trade openness indices.

Table 3.4: OLS Estimation Results with other trade openness indices

Independent Variable	**Coefficient** **Time Period: 1960-2011**	**Coefficient** **Time Period: 1960-2011**	**Coefficient** **Time Period: 1990-2010**	**Coefficient** **Time Period: 1970-2010**
$\Delta LGDP_{t-1}$		-0.35**	-0.18	-0.34***
$\Delta Pcapital_t$	0.02	0.108	0.153	0.07
$\Delta LEdexp_t$	0.15**	0.152***	0.064	0.14**
$\Delta Llabour_t$	-0.57	-0.710	-0.868	-0.16
$\Delta LIPR_t$	-0.03	-0.064		
$\Delta LTax_t$			0.067	
$\Delta LKOFB_t$				-0.07
Trend	0.001***	0.002***	0.002***	0.002***
Constant	0.000	0.01	-0.02	-0.02
	R^2 =0.34 **Ramsey RESET test** H_o: No omitted variables P-value=0.90 **Portmanteau Test for White noise** H_o: No autocorrelation P-value=0.18	R^2 =0.42 **Ramsey RESET test** H_o: No omitted variables P-value=0.27 **Portmanteau Test for White noise** H_o: No autocorrelation P-value=0.34	R^2 =0.67 **Ramsey RESET test** H_o: No omitted variables P-value=0.33 **Portmanteau Test for White noise** H_o: No autocorrelation P-value=0.84	R^2 =0.43 **Ramsey RESET test** H_o: No omitted variables P-value=0.84 **Portmanteau Test for White noise** H_o: No autocorrelation P-value=0.03

Note: Dependent variable=$\Delta LGDP_t$. The errors are heteroskedasticity-robust standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1% respectively. A time trend has also been included in the model.

OLS results imply that trade openness has no effect on GDP growth for the time period 1960-2011. Import penetration ratio seems to have no impact on economic growth. The trade barrier proxies, LTax and LKOFB, also came out to be statistically insignificant. The equation with LKOFB as the trade index suffers from autocorrelation problem. So I estimated the model again using Generalised Least Squares (GLS) method (Prais-Wisnten regression). But the results stayed unchanged (see Table A3.3 in the Appendix). However, I do not draw any conclusion from these results because, as discussed earlier, there can be potential endogeneity bias if causality runs from GDP towards trade and education expenditure. Some past studies show that human capital accumulation too can affect trade and vice versa (Chaudhry et al., 2010). I therefore estimate my model again using Vector Autoregression (VAR) modelling technique in order to examine the directions of causality. The term “autoregressive” is due to the appearance of the lagged value of the dependent variable on the right-hand side and the term “vector” is used because we have a vector of 2 or more variables. A VAR is an n-equation, n-variable linear model in which each variable is explained by its own lagged values as well as current and past values of the remaining n-1 variables. The variable, size of labour force (LLabour) will be treated as exogenous variable in the VAR system. The reason is that size of the labour force depends on the demographic features of a country. To confirm whether ‘LLabour’ is actually exogenous or not, I first estimated the VAR model with ‘LLabour’ as an endogenous variable. The results confirmed that it is not caused by any other variable in my model.

The VAR system of equations with total trade share (Trade) as trade openness index looks as follows. The optimal number of lags is 1 as determined by Akaike Information Criterion (AIC).

$$\Delta LGDP_t=\beta_0+\beta_1\Delta LGDP_{t-1}+\beta_2\Delta Pcapital_{t-1}+\beta_3\Delta LEdexp_{t-1}+\beta_4\Delta LTrade_{t-1}+\mu_{1t} \quad (8)$$

$$\Delta LPcapital_t=\delta_0+ \delta_1\Delta LGDP_{t-1}+ \delta_2 \Delta Pcapital_{t-1}+ \delta_3\Delta LEdexp_{t-1}+ \delta_4\Delta LTrade_{t-1}+ \mu_{2t} \quad (9)$$

$$\Delta LEdexp_t= \alpha_0+ \alpha_1\Delta LGDP_{t-1}+ \alpha_2\Delta Pcapital_{t-1}+ \alpha_3\Delta LEdexp_{t-1}+ \alpha_4\Delta LTrade_{t-1}+ \mu_{3t} \quad (10)$$

$$\Delta LTrade_t= \Omega_0+ \Omega_1\Delta LGDP_{t-1}+ \Omega_2\Delta Pcapital_{t-1}+ \Omega_3\Delta LEdexp_{t-1}+ \Omega_4\Delta LTrade_{t-1}+ \mu_{4t} \quad (11)$$

where, the μ’s are the stochastic error terms.

Similarly, equations with other trade openness indices will be specified. The size of labour force, 'LLabour' and a time trend will enter as exogenous variables in the VAR system. The following tables 3.5-3.8 present the VAR estimation results with various trade openness indices.

Table 3.5: VAR Estimation Results with Trade as trade openness index, 1962-2011

Dependent Variable	**Independent Variable**	**Coefficient**
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.26**
	$\Delta LPcapital_{t-1}$	0.04
	$\Delta LEdexp_{t-1}$	0.11
	$\Delta LTrade_{t-1}$	0.09*
	Δ.LLabour	-1.04**
	trend	0.001***
	constant	0.02
$\Delta Pcapital_t$	$\Delta LGDP_{t-1}$	0.15
	$\Delta LPcapital_{t-1}$	-0.38***
	$\Delta LEdexp_{t-1}$	-0.08
	$\Delta LTrade_{t-1}$	-0.01
	Δ.LLabour	0.16
	trend	0.00
	constant	0.00
$\Delta LEDEXP_t$	$\Delta LGDP_{t-1}$	0.06
	$\Delta LPcapital_{t-1}$	0.85**
	$\Delta LEdexp_{t-1}$	0.16
	$\Delta LTrade_{t-1}$	0.04
	Δ.LLabour	-0.08
	trend	-0.00
	constant	0.13**
$\Delta LTRADE_t$	$\Delta LGDP_{t-1}$	-0.41
	$\Delta LPcapital_{t-1}$	1.14**
	$\Delta LEdexp_{t-1}$	-0.10
	$\Delta LTrade_{t-1}$	-0.02
	Δ.LLabour	2.83**
	trend	0.00*
	constant	-0.06

LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.44	Optimal number of lags=1 **Granger Causality Test** H_0 : ΔLEdexp does not cause ΔLGDP P-value=0.11 H_0 : ΔLGDP does not cause ΔLEdexp P-value=0.82 H_0 : ΔLTrade does not cause ΔLGDP P-value=0.92 H_0 : ΔLGDP does not cause ΔLTrade P-value=0.33

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% level respectively. VAR system is stable. See Figure A3.4a in the Appendix.

Table 3.6: VAR Estimation Results with IPR as trade openness index, 1964-2011

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.37***
	$\Delta LGDP_{t-2}$	-0.23
	$\Delta LGDP_{t-3}$	0.03
	$\Delta LPcapital_{t-1}$	-0.02
	$\Delta LPcapital_{t-2}$	-0.17
	$\Delta LPcapital_{t-3}$	-0.03
	$\Delta LEDEXP_{t-1}$	0.19**
	$\Delta LEDEXP_{t-2}$	-0.18**
	$\Delta LEDEXP_{t-3}$	-0.03
	$\Delta LIPR_{t-1}$	0.01
	$\Delta LIPR_{t-2}$	0.02
	$\Delta LIPR_{t-3}$	0.05
	Δ.LLabour	-0.92**
	trend	0.00***
	constant	0.04**
$\Delta Pcapital_t$	$\Delta LGDP_{t-1}$	0.07
	$\Delta LGDP_{t-2}$	0.17
	$\Delta LGDP_{t-3}$	0.09
	$\Delta LPcapital_{t-1}$	-0.61***
	$\Delta LPcapital_{t-2}$	-0.13
	$\Delta LPcapital_{t-3}$	0.15
	$\Delta LEDEXP_{t-1}$	-0.01
	$\Delta LEDEXP_{t-2}$	-0.17***
	$\Delta LEDEXP_{t-3}$	-0.16***
	$\Delta LIPR_{t-1}$	-0.01
	$\Delta LIPR_{t-2}$	0.01
	$\Delta LIPR_{t-3}$	0.01
	Δ.LLabour	0.51
	trend	-0.00
	constant	0.02**
$\Delta LEDEXP_t$	$\Delta LGDP_{t-1}$	0.02
	$\Delta LGDP_{t-2}$	0.06
	$\Delta LGDP_{t-3}$	-0.15
	$\Delta LPcapital_{t-1}$	0.59
	$\Delta LPcapital_{t-2}$	-0.49
	$\Delta LPcapital_{t-3}$	0.39
	$\Delta LEDEXP_{t-1}$	0.22
	$\Delta LEDEXP_{t-2}$	-0.03
	$\Delta LEDEXP_{t-3}$	0.00
	$\Delta LIPR_{t-1}$	0.03
	$\Delta LIPR_{t-2}$	-0.02
	$\Delta LIPR_{t-3}$	0.07
	Δ.LLabour	-0.63
	trend	-0.00
	constant	0.15***
$\Delta LIPR_t$	$\Delta LGDP_{t-1}$	-1.62***
	$\Delta LGDP_{t-2}$	-0.l7
	$\Delta LGDP_{t-3}$	-0.26
	$\Delta LPcapital_{t-1}$	1.02
	$\Delta LPcapital_{t-2}$	0.51

	ΔLPcapital $_{t-3}$ ΔLEDEXP $_{t-1}$ ΔLEDEXP $_{t-2}$ ΔLEDEXP $_{t-3}$ ΔLIPR $_{t-1}$ ΔLIPR$_{t-2}$ ΔLIPR $_{t-3}$ Δ.LLabour trend constant	0.86 0.17 -0.07 -0.52* -0.05 -0.11 -0.17 3.74** 0.00** -0.04
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.06 H_0 : No Autocorrelation at lag order 2 P-value=0.13 H_0 : No Autocorrelation at lag order 3 P-value=0.10	Optimal number of lags=3 **Granger Causality Test** H_0 : ΔLEdexp does not cause ΔLGDP P-value=0.01 H_0 : ΔLGDP does not cause ΔLEdexp P-value=0.93 H_0 : ΔLIPR does not cause ΔLGDP P-value=0.33 H_0 : ΔLGDP does not cause ΔLIPR P-value=0.06	

Note: VAR system is stable. See Figure A3.4b in the Appendix.

Table 3.7: VAR Estimation Results with Tax as trade openness index, 1993 - 2010

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.05
	$\Delta LGDP_{t-2}$	0.24
	$\Delta LPcapital_{t-1}$	0.10
	$\Delta LPcapital_{t-2}$	-0.04
	$\Delta LEDEXP_{t-1}$	0.20***
	$\Delta LEDEXP_{t-2}$	-0.23***
	$\Delta LTax_{t-1}$	-0.01
	$\Delta LTax_{t-2}$	0.02
	Δ.LLabour	0.32
	trend	0.00
	constant	0.01
$\Delta Pcapital_t$	$\Delta LGDP_{t-1}$	0.99*
	$\Delta LGDP_{t-2}$	0.81
	$\Delta LPcapital_{t-1}$	-0.61***
	$\Delta LPcapital_{t-2}$	-0.30
	$\Delta LEDEXP_{t-1}$	0.10
	$\Delta LEDEXP_{t-2}$	-0.42***
	$\Delta LTax_{t-1}$	-0.10
	$\Delta LTax_{t-2}$	-0.01
	Δ.LLabour	1.88
	trend	-0.00
	constant	0.00
$\Delta LEDEXP_t$	$\Delta LGDP_{t-1}$	1.32
	$\Delta LGDP_{t-2}$	0.26
	$\Delta LPcapital_{t-1}$	0.43
	$\Delta LPcapital_{t-2}$	-0.62
	$\Delta LEDEXP_{t-1}$	0.70***
	$\Delta LEDEXP_{t-2}$	-0.64***
	$\Delta LTax_{t-1}$	-0.35**
	$\Delta LTax_{t-2}$	0.24
	Δ.LLabour	-4.17*
	trend	-0.00
	constant	0.19**
$\Delta LTax_t$	$\Delta LGDP_{t-1}$	5.57***
	$\Delta LGDP_{t-2}$	2.60*
	$\Delta LPcapital_{t-1}$	0.78
	$\Delta LPcapital_{t-2}$	-0.56
	$\Delta LEDEXP_{t-1}$	0.23
	$\Delta LEDEXP_{t-2}$	-1.05***
	$\Delta LTax_{t-1}$	-0.75***
	$\Delta LTax_{t-2}$	-0.41
	Δ.LLabour	2.35
	trend	-0.02***
	constant	0.24*

LM Test for Autocorrelation	**Granger Causality Test**
H_0 : No Autocorrelation at lag order 1 P-value=0.49 H_0 : No Autocorrelation at lag order 2 P-value=0.17 Optimal number of lags=2	H_0 : ΔLEdexp does not cause ΔLGDP P-value=0.00 H_0 : ΔLGDP does not cause ΔLEdexp P-value=0.21 H_0 : ΔLTax does not cause ΔLGDP P-value=0.89 H_0 : ΔLGDP does not cause ΔLTax P-value=0.00

Note: VAR system is stable. See Figure A3.4c in the Appendix.

Table 3.8: VAR Estimation Results with KOFB as trade openness index, 1973 - 2009

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.30**
	$\Delta LGDP_{t-2}$	-0.09
	$\Delta LPcapital_{t-1}$	0.04
	$\Delta LPcapital_{t-2}$	-0.15
	$\Delta LEDEXP_{t-1}$	0.24***
	$\Delta LEDEXP_{t-2}$	-0.23***
	$\Delta LKOFB_{t-1}$	-0.02
	$\Delta LKOFB_{t-2}$	-0.01
	Δ.LLabour	-0.11
	trend	0.00***
	constant	0.00
$\Delta Pcapital_t$	$\Delta LGDP_{t-1}$	0.40***
	$\Delta LGDP_{t-2}$	0.21
	$\Delta LPcapital_{t-1}$	-0.53***
	$\Delta LPcapital_{t-2}$	-0.09
	$\Delta LEDEXP_{t-1}$	-0.06
	$\Delta LEDEXP_{t-2}$	-0.22***
	$\Delta LKOFB_{t-1}$	-0.02
	$\Delta LKOFB_{t-2}$	-0.02
	Δ.LLabour	0.99
	trend	-0.00
	constant	0.00
$\Delta LEDEXP_t$	$\Delta LGDP_{t-1}$	0.44
	$\Delta LGDP_{t-2}$	0.53
	$\Delta LPcapital_{t-1}$	0.65*
	$\Delta LPcapital_{t-2}$	-0.39
	$\Delta LEDEXP_{t-1}$	0.05
	$\Delta LEDEXP_{t-2}$	-0.12
	$\Delta LKOFB_{t-1}$	0.03
	$\Delta LKOFB_{t-2}$	-0.03
	Δ.LLabour	-3.66*
	trend	-0.00***
	constant	0.36***
$\Delta LKOFB_t$	$\Delta LGDP_{t-1}$	-0.28
	$\Delta LGDP_{t-2}$	-0.11
	$\Delta LPcapital_{t-1}$	0.32
	$\Delta LPcapital_{t-2}$	-0.34
	$\Delta LEDEXP_{t-1}$	-0.19
	$\Delta LEDEXP_{t-2}$	0.01
	$\Delta LKOFB_{t-1}$	-0.13
	$\Delta LKOFB_{t-2}$	0.02
	Δ.LLabour	0.03
	trend	0.00
	constant	0.01

LM Test for Autocorrelation	Granger Causality Test
H_0 : No Autocorrelation at lag order 1 P-value=0.91 H_0 : No Autocorrelation at lag order 2 P-value=0.76 Optimal number of lags=2	H_0 : ΔLEdexp does not cause ΔLGDP (P-value=0.00) H_0 : ΔLGDP does not cause ΔLEdexp (P-value=0.28) H_0 : ΔLKOFB does not cause ΔLGDP (P-value=0.92) H_0 : ΔLGDP does not cause ΔLKOFB (P-value=0.85)

Note: VAR system is stable. See Figure A3.4d in the Appendix.

Overall, it seems that education expenditure shares a significant relationship with growth. Contrary to some of the past studies (Pradhan, 2009), I do not find any evidence that there is a reverse causality from economic growth towards public education expenditure. This finding is expected because education policies at the central level are never contingent on economic performance in India. Hence, the budget allotted by the central government towards education should not be any way determined by growth performance. However, as seen in Tables 3.6-3.8, the positive first lag effect is followed by negative effect in the subsequent lag which makes the overall impact ambiguous. In short, it is hard to comment on the education expenditure-growth relationship by looking at the aggregate level data.

The results suggest that trade barriers have no effects on growth. This finding is consistent across OLS and VAR estimation results. I tried examining the relationship between trade barriers and growth using other trade barrier measures such as custom and other import duties (as percentage of tax revenue) and Effectively Applied Tariff Rates also. But I failed to find any relationship. One reason for this lack of a relation can be attributed to data limitations. Data on these measures is only available only from 1990 onwards. The other challenge is that there is no clear consensus on how to define a "perfect" indicator of trade restrictions. Most of the simple measures of trade barriers suffer from some limitation or the other.[21] Maybe that is why, as Rodriguez and Rodrik (2001) say,

"*Simple measures of trade barriers tend not to enter significantly in well-specified growth regressions, regardless of time periods, subsamples, or the conditioning variables employed.*"

Conversely, I find some evidence of reverse causality from GDP growth towards rate of increase in trade taxes. Higher the growth rate of the Indian economy, higher the share of

[21] See Rodriguez and Rodrik (2001) for a detailed discussion on the shortcomings of measures of trade restrictions.

trade taxes in total tax revenue. Regarding trade volumes, rate of increase in import share has no effect on GDP growth. Total trade share does have an effect but it is very weak (significant at 10% level). These findings are consistent with some of the previous time series studies on India such as Sarkar (2005) and Sarkar (2005a). However, the potential econometric problem in the previous empirical studies is that they estimate an “average” relationship between the two variables. If there has been a trend break in the Indian growth, which is actually the case, then the average regression function can be quite different from the true regression function at the end of the sample period. Estimating such an average regression function assumes that the parameters (coefficients of the explanatory variables) are constant for the entire sample period and if there has indeed been a break then this may lead to inaccurate findings.

India’s history of growth since independence can be broadly divided into two policy regimes (Aggarwal and Kumar, 2012). During 1951-80, the focus was to achieve growth with social justice following a state-led growth model. The public sector was the key player in the economy. Since 1980-81 onwards, India began to move towards an open and liberal regime. There was a clear shift in industrial policies in favour of a market-led growth through domestic decontrols from 1980-81 onwards as the country faced stagnating industrial growth. Some reforms were initiated in the foreign trade sector also. This process of reforms further accelerated in mid-1980s and were followed by deeper and more systematic liberalisation measures from 1991-92 onwards.

Many existing studies also show that the major structural break in India’s growth occurred around 1980. Sinha and Tejani (2004) say that the long-term growth trend appears to break upward from 1980 onwards. The average growth rate of real GDP increased from 3.5% during 1950-1979 to around 5.5% during 1980-2000. Rodrik and Subramanian (2004) show that India’s GDP per capita growth more than doubled since 1980, rising from 1.7% during

1950-80 to 3.8% during 1980-2000. They do a structural break test (Bai and Perron Test) and find that the break occurs in 1979. Wallack (2003) studies GDP and its disaggregated components for structural breaks and finds the evidence of a break in 1980. [22]

So if there is a break in 1980-81 in Indian GDP growth, then one cannot estimate an average regression function because the parameters will not be constant over the sample period and hence the results will be inaccurate. In other words, the existence of a break may have affected the results presented in Tables 3.5-3.8.

Hence, I re-estimate the model given the fact that there has been a change in policy regime after 1980 onwards. A parameter stability test called the Chow Test has been conducted to confirm the trend break in India's GDP growth rate in 1980. The sample period has been divided into two groups-1970-79 and 1980-2010. The Chow test examines whether the parameters (coefficients on LEdexp, Pcapital and the trade variables) are different for the two different time periods and I find that to be true. I create a dummy variable (dummy80) and a group of interaction terms of the regressors and the dummy variable. The dummy takes the value of 1 for years after 1980 and 0 otherwise. The idea behind creating the interaction terms is to check whether trade openness has any impact on India's growth after the policy shift in 1980-81.

Also, as seen in the previous estimation results, physical capital (Pcapital) has always come out to be statistically insignificant. This finding is unexpected since growth theories suggest that physical capital is one of the main determinants of economic growth. Assuming that there is some serious measurement error in the variable, I replace my previous proxy for physical capital (gross capital formation as percentage of GDP) with net fixed capital stock (NFCS) and see whether this new variable improves my model. I verified that this

[22]Wallack (2003) finds the evidence of the break date in the early to mid-1980s. In 1980, the highest value of the F-statistic associated with the existence of a break is reached.

replacement of proxy does not change my main results (see Krueger and Lindahl, 2001 for a detailed discussion on the issue of measurement error in physical capital calculations).

I re-estimate the econometric model (equation 7) by incorporating the dummy variable and the interaction terms and then conduct the Chow test.[23] The null hypothesis is that the two different regimes or time period have the same parameters for the explanatory variables and the same intercept. The null is rejected because the coefficient on dummy80 and the interaction terms are significantly different from zero, as seen in Table 3.9 below.

Table 3.9: Chow Test Results for Regressions with IPR (Column a) and Trade (Column b) as trade openness indices

(a)	**(b)**
H_0 : Intercept and parameters are same for 1970-79 and 1980-2010	H_0 : Intercept and parameters are same for 1970-79 and 1980-2010
P-value=0.00	P-value=0.00

This implies that after 1980, the nature of impact of trade openness on growth is very likely to have changed. So the VAR model is re-estimated with the interaction terms and the dummy variable. The results are presented in Tables 3.10-3.12 below.

[23] I do this only for regression equations with the trade volume measures (IPR and TS) as trade openness indices. I could not repeat this exercise for TAX because data is available only from 1990 onwards. I do not do this for KOFB because trade barriers remained high throughout 1980s (see Sinha and Tejani, 2004). In fact, the average effective rate of protection for industries went up from 115.1% (during 1980-85) to 125.9% (during 1986-90). So, it is unlikely that trade barriers will exhibit any relationship with the surge in GDP growth during the post-1980 period. The VAR results presented in Table 3.12 provides support to this assertion. Also, see Rodrik and Subramanian (2004) and Das (2003) for details.

Table 3.10: VAR Estimation Results with IPR and period dummy

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.26*
	$\Delta LNFCS80_{t-1}$	-0.05
	$\Delta LEdexp80_{t-1}$	0.09
	$\Delta LIPR80_{t-1}$	1.59***
	Δ.LLabour	0.36
	dummy80	0.03*
	constant	0.03
$\Delta LNFCS80_t$	$\Delta LGDP_{t-1}$	0.05
	$\Delta LNFCS80_{t-1}$	0.18
	$\Delta LEdexp80_{t-1}$	-0.02
	$\Delta LIPR80_{t-1}$	0.07
	Δ.LLabour	-0.58
	dummy80	0.03***
	constant	0.01
$\Delta LEdexp_t$	$\Delta LGDP_{t-1}$	0.08
	$\Delta LNFCS80_{t-1}$	0.49
	$\Delta LEdexp80_{t-1}$	0.01
	$\Delta LIPR80_{t-1}$	-1.25
	Δ.LLabour	-2.85**
	dummy80	0.10***
	constant	0.03
$\Delta LIPR_t$	$\Delta LGDP_{t-1}$	0.05
	$\Delta LNFCS80_{t-1}$	-0.06
	$\Delta LEdexp80_{t-1}$	-0.06*
	$\Delta LIPR80_{t-1}$	0.42***
	Δ.LLabour	-0.11
	dummy80	0.01**
	constant	0.0001
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.43	Optimal number of lags=1 **Granger Causality Test** H_0 : ΔLIPR does not cause ΔLGDP P-value=0.00 H_0 : ΔLGDP does not cause ΔLIPR P-value=0.30	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% respectively. IPR80 is the interaction term between IPR and the period dummy for post-1980 years, Edexp80 is the interaction term between Edexp and the dummy variable and so on. VAR system is stable. See Figure A3.4(a) in the Appendix.

The results indicate that import penetration ratio (IPR) has a positive impact on GDP growth. The short-run Granger Causality test results suggest that there is a uni-directional causality running from import penetration ratio towards GDP but not vice versa. In other words, after the policy shift in 1980-81, trade openness started to have a statistically significant impact on growth. The table below gives a similar picture even when we use total trade as percentage of GDP as the proxy for openness instead of IPR. Again, the Granger causality test results indicate that the causality runs from total trade share towards GDP. [24]

[24]The finding, that growth in trade openness accelerates economic growth rate, is being upheld if we use exports/GDP as a proxy for openness. I do not report these results in the study.

Table 3.11: VAR Estimation Results with Trade and period dummy

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.29*
	$\Delta LGDP_{t-2}$	-0.04
	$\Delta LNFCS80_{t-1}$	0.02
	$\Delta LNFCS80_{t-2}$	0.07
	$\Delta LEdexp80_{t-1}$	0.13*
	$\Delta LEdexp80_{t-2}$	-0.11
	$\Delta LTrade80_{t-1}$	0.68*
	$\Delta LTrade80_{t-2}$	0.32
	Δ.LLabour	0.51
	dummy80	0.02*
	constant	0.03
$\Delta LNFCS_t$	$\Delta LGDP_{t-1}$	0.05
	$\Delta LGDP_{t-2}$	0.01
	$\Delta LNFCS80_{t-1}$	0.38**
	$\Delta LNFCS80_{t-2}$	0.27*
	$\Delta LEdexp80_{t-1}$	0.02
	$\Delta LEdexp80_{t-2}$	-0.18**
	$\Delta LTrade80_{t-1}$	0.44*
	$\Delta LTrade80_{t-2}$	0.47**
	Δ.LLabour	-0.41
	dummy80	0.03***
	constant	0.01
$\Delta LEdexp_t$	$\Delta LGDP_{t-1}$	0.53
	$\Delta LGDP_{t-2}$	0.33
	$\Delta LNFCS80_{t-1}$	0.67
	$\Delta LNFCS80_{t-2}$	-0.20
	$\Delta LEdexp80_{t-1}$	0.06
	$\Delta LEdexp80_{t-2}$	-0.17
	$\Delta LTrade80_{t-1}$	-1.27*
	$\Delta LTrade80_{t-2}$	-1.2
	Δ.LLabour	-3.62
	dummy80	0.14***
	constant	0.07
$\Delta LTrade_t$	$\Delta LGDP_{t-1}$	0.11
	$\Delta LGDP_{t-2}$	0.08
	$\Delta LNFCS80_{t-1}$	0.13
	$\Delta LNFCS80_{t-2}$	-0.22*
	$\Delta LEdexp80_{t-1}$	-0.06
	$\Delta LEdexp80_{t-2}$	-0.02
	$\Delta LTrade80_{t-1}$	0.04
	$\Delta LTrade80_{t-2}$	0.67***
	Δ.LLabour	0.24
	dummy80	0.02**
	constant	-0.01

LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.77 H_0 : No Autocorrelation at lag order 2 P-value=0.17	Optimal number of lags=2 **Granger Causality Test** H_0 : ΔLTrade does not cause ΔLGDP P-value=0.08 H_0 : ΔLGDP does not cause ΔLTrade P-value=0.31

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% respectively. VAR system is stable. See Figure A3.4 (b) in the Appendix.

The relationship could not be re-tested for Total taxes on International trade (% of revenue) because of data limitations. We used another variable (KOFB) which acted as a proxy for trade restrictions to re-estimate the relationship between trade restrictions and growth. The conclusion remains unchanged in the context of the relation between trade barriers and growth. In the VAR equation with KOFB as the dependent variable we find the period dummy (dummy80) to be statistically insignificant. This implies that the intercept did not change across the two policy regimes (pre-1980 and post 1980). This is actually consistent with the empirical evidence because the reforms carried out in the 1980s did not involve reduction in tariffs and other trade barriers. In fact, Das (2003) and Rodrik and Subramanian (2004) discuss how the average effective rate of protection actually went up at an aggregate industry level during the 1980s in India.

Table 3.12: VAR Estimation Results with KOFB and period dummy

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$	-0.11
	$\Delta LGDP_{t-2}$	0.10
	$\Delta LNFCS80_{t-1}$	0.22
	$\Delta LNFCS80_{t-2}$	0.09
	$\Delta LEdexp80_{t-1}$	0.10
	$\Delta LEdexp80_{t-2}$	-0.20
	$\Delta LKOFB80_{t-1}$	0.02
	$\Delta LKOFB80_{t-2}$	0.03
	Δ.LLabour	0.28
	dummy80	0.03*
	constant	0.02
$\Delta LNFCS_t$	$\Delta LGDP_{t-1}$	0.07
	$\Delta LGDP_{t-2}$	-0.05
	$\Delta LNFCS80_{t-1}$	0.18
	$\Delta LNFCS80_{t-2}$	0.42***
	$\Delta LEdexp80_{t-1}$	-0.01
	$\Delta LEdexp80_{t-2}$	-0.15**
	$\Delta LKOFB80_{t-1}$	-0.01
	$\Delta LKOFB80_{t-2}$	-0.01
	Δ.LLabour	-0.67
	dummy80	0.03***
	constant	0.02
$\Delta LEdexp_t$	$\Delta LGDP_{t-1}$	0.09
	$\Delta LGDP_{t-2}$	0.01
	$\Delta LNFCS80_{t-1}$	0.43
	$\Delta LNFCS80_{t-2}$	-0.30
	$\Delta LEdexp80_{t-1}$	0.01
	$\Delta LEdexp80_{t-2}$	-0.01
	$\Delta LKOFB80_{t-1}$	-0.12
	$\Delta LKOFB80_{t-2}$	-0.11
	Δ.LLabour	-2.81
	dummy80	0.12***
	constant	0.07
$\Delta LKOFB_t$	$\Delta LGDP_{t-1}$	0.07
	$\Delta LGDP_{t-2}$	0.43
	$\Delta LNFCS80_{t-1}$	0.13
	$\Delta LNFCS80_{t-2}$	0.42
	$\Delta LEdexp80_{t-1}$	-0.25
	$\Delta LEdexp80_{t-2}$	0.08
	$\Delta LKOFB80_{t-1}$	-0.15
	$\Delta LKOFB80_{t-2}$	0.03
	Δ.LLabour	2.76
	dummy80	0.05
	constant	-0.09*

LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.77 H_0 : No Autocorrelation at lag order 2 P-value=0.17	Optimal number of lags=2 **Granger Causality Test** H_0 : ΔLKOFB does not cause ΔLGDP P-value=0.88 H_0 : ΔLGDP does not cause ΔLKOFB P-value=0.54

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% respectively. VAR system is stable. See Figure A3.4(c) in the Appendix.

As said previously, rate of increase in trade volumes now seem to affect GDP growth rate positively from 1980 onwards after Indian economy shifted from a state-led growth model to a pro-business regime. Both import share and total trade share in GDP exhibit a positive and statistically significant growth effect. In case of total trade share (Trade), I found that the first lag is significant whereas the second lag is not. However, the Granger causality test confirmed the joint significance of both the lags of 'Trade'. The finding that trade barriers have no effect on growth was upheld. There is no evidence of reverse causality from GDP towards trade volumes. It seems that only rate of increase in trade tax revenues (Tax) is influenced by GDP growth. This may imply that as the country is growing as a result of increasing trade openness, its exports and imports are increasing and consequently the total taxes collected on trade is also going up.

Public education expenditure overall exerts a positive influence on GDP growth but the effect seems to be non-robust. There can be many possible reasons. Devarajan et al. (1996) examine the public expenditure on education-growth link for a sample of 43 developing countries and do not observe any positive relationship. They say that the problem of misallocation of resources is a major issue in developing countries which may reduce the effectiveness of education investments. Alternatively, it is possible that the relationship is too complex to be captured by any study using aggregate level data. A disadvantage of aggregate level study is that it misses the dynamics at work at the sectoral level. If the growth effects of public expenditure in different education sectors (such as, primary, secondary and tertiary sectors) are different then an aggregate level analysis may produce inconsistent results. Furthermore, if the relationship between any sectoral expenditure and growth changes over time (following a regime change, for example) then such parameter change may also lead to varied findings.

Among the other variables, physical capital and size of labour force share no significant relationship with growth. The effects of these variables seem to be fragile and the sign and magnitude of the coefficients seem sensitive to model specifications.

3.5 Conclusion

The chapter tried to examine the relationship between public education expenditure, trade openness and economic growth of India using time series econometric techniques. The results, overall, hint towards a positive nexus between growth rate in education expenditure and GDP growth which is contrary to the findings of most of the past studies on India such as Ansari and Singh (1997), Bosworth et al. (2007) and Pradhan (2009). However, it should be noted that the empirical relationship is not very robust. It is possible that the relationship is too complex to be captured by any study using aggregate level data. A disadvantage of aggregate level study is that it misses the dynamics at work at the sectoral level. If the nature of the relationship between public expenditure in different education sectors (such as, primary, secondary and tertiary sectors) and growth are different then such aggregate level study may produce inconsistent results. Furthermore, if the relationship between any sectoral expenditure and growth changes over time then such parameter change may also lead to varied findings. I will therefore once again investigate the empirical relationship between education expenditure and growth using sectoral level data in chapter 4.

The main contribution of this chapter has been to identify the dynamism in empirical relationship between trade openness and economic growth of India. Many previous studies have studied this relationship and the findings of the overall existing literature are mixed. One major caveat of the past studies has been to ignore the change in the Indian policy regime since 1980. Hence, it is possible that different studies using different time periods have ended up with varied findings. To the best of my knowledge, this is the first study to show how the nature of the relationship between trade and growth has changed over time.

Econometric analysis shows that trade openness has no effect on India's growth till the 1970s when the Indian economy followed a state-led model of growth. Once the country started to adopt a pro-business regime by undertaking various industrial reforms (such as, gradual abolition of 'license-raj' and various corporate taxes) we could see a significant and positive effect of trade on growth.

However, it is only the measures of trade volumes (import penetration ratio and total trade share) which exerted a positive effect, not the measures of trade barriers. In other words, I found that an increase in import penetration ratio and total trade share leads to an increase in GDP growth rate of India. From 1980s onwards, Indian industries started importing superior intermediate and capital goods in spite of high tariffs which increased labour productivity and consequently led to faster economic growth (Sinha and Tejani, 2004).

As mentioned earlier, measures of trade barriers (denoted as 'Tax' and 'KOFB') do not seem to have any significant growth effects. This is probably because-firstly, data limitation and lack of accurate measures of trade barriers have been a major problem in this sort of empirical examinations. Data on 'Tax' is only available from 1990 onwards so it could not be examined whether the relationship has undergone any change over time; and secondly, even if data were available it is possible that the trade barrier-growth relationship has not changed after 1980 because reduction of trade barriers did not happen until the 1990s trade reforms and, hence, protectionism was still high during the 1980s.

On the contrary, there is some evidence of reverse causality from growth towards 'Tax'. This may imply that as India is growing as a result of increasing its trade openness, its exports and imports are increasing and as a result the total taxes collected on trade are also rising.

Appendix 3

Table A3.13: Data Source

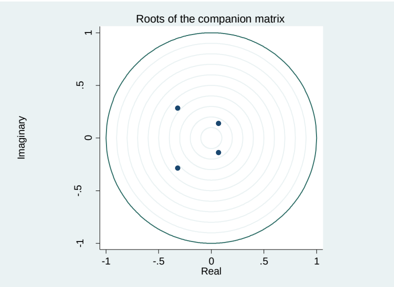
Variable	Source
GDP	Handbook of Statistics on Indian Economy 2012 published by Reserve Bank of India. Accessed at http://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook+of+Statistics+on+Indian+Economy
Public Education Expenditure	Union Budget(various issues) of Government of India. Accessed at http://indiabudget.nic.in/ Ministry of Human Resource Development, Government of India. Accessed at http://mhrd.gov.in
Total trade share, Import Penetration Ratio, Total Taxes on International Trade as % of revenue	World Development Indicators, 2012
KOFB	KOF Index of Globalization. Accessed at http://globalization.kof.ethz.ch.
Gross capital formation as % of GDP	Handbook of Statistics on Indian Economy 2012, RBI
Net fixed capital stockat 1993-94 prices (in INR, crores)	Data used from National Accounts Statistics, Central Statistical Organisation, Government of India.
Size of labour force	Handbook of Statistics on Indian Economy 2012, RBI

Table A3.14: Prais-Winsten Regression with KOFB as trade openness index

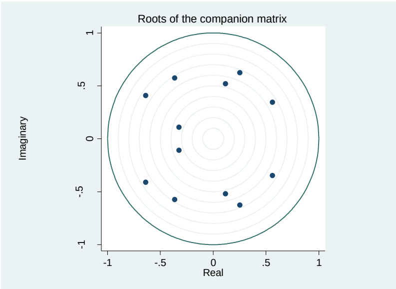
Independent Variable	**Coefficient** **Time Period: 1970-2010**	**Coefficient** **Time Period: 1970-2010**
$\Delta LGDP_t$ (-1)		-0.127
$\Delta Pcapital_t$	0.068	0.090
$\Delta LEdexp_t$	0.201***	0.211***
$\Delta Llabour_t$	0.531	0.471
$\Delta LKOFB_t$	-0.052	-0.059
Trend	0.002***	0.002***
Constant	0.060*	0.060*
	R^2 =0.631	R^2 =0.620

Note: Dependent variable=$\Delta LGDP_t$. The errors are heteroskedasticity-robust standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1% respectively. A time trend has also been included in the model.

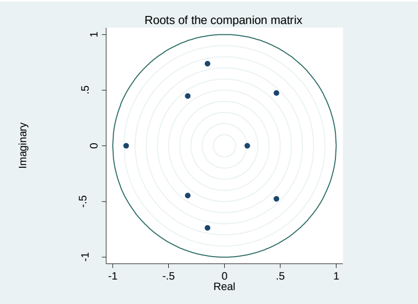
Figure A3.1: Unit root circle



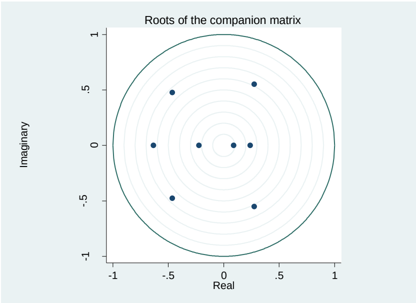
(a)



(b)

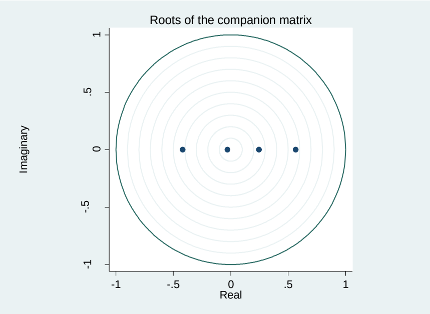


(c)

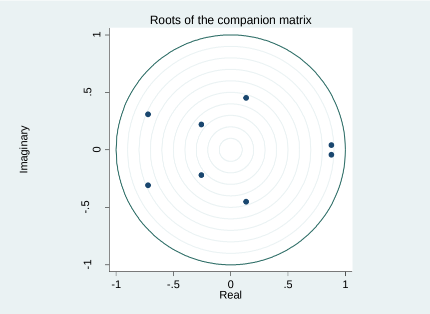


(d)

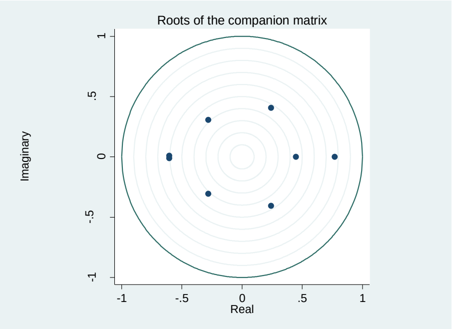
Figure A3.2: Unit root circle after VAR estimation with period dummies



(a)



(b)



(c)

Chapter 4: Relationship between trade openness and economic growth of India: Analysis at the Disaggregated Level

Background

I tested the relationship between trade openness and economic growth at an aggregate level using country level data in Chapter 3. In this chapter, I will reexamine the relationship at disaggregated level. Disaggregation has been done at two levels-sectoral and state levels.

Firstly, I check the trade-growth association at a sectoral level in Chapter 4.1. The aim behind doing this exercise is to see how each sector-namely, agriculture, manufacturing and services sectors reacted to increasing trade openness in India. Such an exercise is important because, the growth experience of each of the aforementioned sectors has been considerably different during the post-reform period. After India started to undertake industrial and trade reforms since the 1980s and 1990s respectively, the agricultural sector's share has shrunk, that of manufacturing has been more or less stagnant and the services sector's share has increased rapidly (see Table 4.1). Relatively speaking, the services sector has grown at a much faster pace than the other two sectors during the post-reform period (see Table 4.2). There are, thus, reasons to suspect that trade openness has affected each sector differently. The differential performance across sectors may also neutralise the overall effects of trade openness, as many previous studies on India failed to find any growth effect of trade. For instance, if one sector shrinks and another grows (at least relatively) because of trade then analysis at an aggregate level may produce misleading results. That is why a sectoral level empirical investigation is important.

Secondly, I test the trade-growth connection at the state level in Chapter 4.2. In this sub-chapter, I test whether manufacturing growth has been influenced by trade openness at the state level. Unfortunately, state level trade data is not available for most Indian states. That is why I create proxies for state level trade openness using industry level data. Repeating this exercise was not possible for agriculture or services sector because of data limitations. State-level industrial production data is available from ASI. On the basis of that, state level trade openness indices were constructed. But no such database exists for other sectors. The importance of doing this exercise lies in the fact that manufacturing growth performance varies drastically across states during the post-reform period. In spite of an unimpressive manufacturing performance at the country level, some states managed to register rapid manufacturing growth after the trade reforms were undertaken. Thus, ignoring the state level disparities may lead to misleading conclusions regarding the growth effects of trade openness. Virtually no study exists which has tried to examine the trade-growth state-level link because of data limitations. My investigation is a humble attempt to extend the existing trade literature on India in this direction. I have also disaggregated the state level manufacturing data further into registered and unregistered sectors and tried to see how each of the two sectors responded to trade openness.

Chapter 4.1: Analysis of the empirical relationship between sectoral GDP and sectoral trade openness

4.1.1 Introduction

Trade Openness and Agricultural Sector of India

The theoretical literature on the relationship between trade openness and agriculture is quite ambiguous (see Vakulabharanam, 2005). [25] One school of thought believes that there is always a policy bias against agriculture during pre-liberalisation period in less developed countries where output prices are artificially kept low and input prices are distorted through subsidies. Opening up the agricultural sector to international trade reduces the distortions in input prices by removing the subsidies and increases the price of the output by removing the difference between domestic price and world price. The higher prices will attract further investment which will boost growth. Further, removing import restrictions will force reallocation of resources into the sub-sectors of agriculture where the domestic country has a comparative advantage. Thus, the agriculture sector will become overall more efficient and experience faster growth. However, there are some who question the arguments given in favour of agricultural trade liberalisation. For example, Reddy (2002) and Rao and Storm (2003) say that the competition is not even for the developing and developed countries because the farmers in developed countries get more subsidies (thus, more protection) than those in the developing countries. Hence, developing countries may face competition from cheap imports from abroad leading to a decline in growth of the agriculture sector in the former.

India formally agreed to open up its agricultural sector under the Agreement of Agriculture (AoA) in 1994. Many studies say that the growth rate of Indian agriculture declined during

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[25] See Vakulabharanam (2005) and the references cited therein for a detailed discussion.

the post liberalisation period. In fact, many attribute this deceleration in the growth rate to the regime change when the economy started to become increasingly open during the 1990s (see for example, Dhar and Kallumal, 2004; Chand et al., 2007 and Vakulabharanam et al., 2007 among others). One of the main reasons is because the focus of the reforms was mainly on industry, finance and trade openness and agriculture was largely ignored (Dhar and Kallumal, 2004 and Vakulabharanam, 2005).

Chand et al. (2007) show that during the initial years of liberalisation agricultural growth accelerated from 3.12% during the 1980s to 3.64% during the period 1990-1996 and afterwards declined to 1.66% during 1996 to 2004. This initial rise in growth was driven by growth in horticulture crops and fishery due to the favourable terms of trade during the first phase of the reforms. The depreciation of the exchange rate can also be regarded as a potential driver of this growth which moved the relative prices in favour of agriculture and helped agricultural exports. The share of India’s agricultural exports in world exports increased from 1.1% in 1990 to about 1.9% in 1999 (Singh 2011). However, during the later years of the post-liberalisation era, withdrawal of the state intervention led to a decline in public investment in agriculture and decrease in subsidies on inputs and irrigation adversely affected the growth of the same.

Sen (2003) and Patnaik (2003) also say that the decline in agricultural growth can be attributed to a withdrawal of state support to agriculture after liberalisation. During the pre-liberalisation years, the state used to give subsidised inputs, infrastructural support (irrigation and electricity) and minimum support prices to agriculture. However, after India started to adopt an increasingly open regime the state started to withdraw the support which might have dampened growth in the agriculture sector.

Vakulabharanam et al. (2007) opine that the slowdown in growth rates can be attributed partly to the decreasing returns of green revolution technologies over time and partly to liberalisation policies adopted towards agriculture during 1990s. Indian agriculture experienced a change in the cropping pattern-from light to cash crops during the last two decades. While the cultivated area of these crops has grown their prices have been experiencing a sharp and persistent fall after the 1990s. This has consequently led to a decline in the output prices. At the same time, with rising input prices and declining input subsidies, the costs of production have gone up. Reddy (2006) and Suri (2007) also argue that "agrarian distress" is result of the liberalisation policies which prematurely pushed the Indian agriculture into the global markets without a level-playing field.

However, some studies such as Balakrishnan et al. (2008) say that the view, that the regime change starting from 1991 is responsible for the dismal performance of the agriculture, is 'limited'. Factors such as lack of public investment in infrastructure (such as irrigation) and Research and Development (R & D) and lack of institutional and financial market reforms are mainly responsible for a slow growth. Though private investment has been increasing at an impressive rate in agriculture, still the two are not comparable since public investment is "non-excludable" such as investment in roads and irrigation and hence is unlikely to be undertaken by the profit-oriented private sector. Ecological decline such as soil erosion and decline in water availability have also affected growth adversely. In other words, the state has to take the responsibility of providing the necessary infrastructure (such as irrigation facilities) to the farmers and there is no alternate solution to this. In 2009, only 32% of the agricultural land was under irrigation and the remaining land still depended on rainfall for cultivation (Agricultural Statistics at a Glance, 2012).

In short, it seems that though necessary trade reforms have been undertaken yet the agriculture sector seriously lacks in other policy reforms such as governance and institutions.

Trade Openness and Manufacturing Sector of India

India's post-independence industrial strategy adopted during the late 1950s was primarily based on import substitution (Goldberg et al., 2008 and Veeramani, 2012). Import substitution was a strategy of encouraging an expansion of domestic production by restricting imports of manufactured goods from foreign industries. The infant industry argument provided the most popular rationale for protection among policymakers. The crux of the argument was that the industry is unable to compete currently but may be able to do so in the "future". Accordingly, India adopted a restrictive regime during the 1950s which more or less continued till the early 1980s. Several restrictive measures such as quantitative restrictions on imports and foreign exchange controls were undertaken. Industrial policy operated through a complex system of industrial licensing with the state taking all the major investment decisions.

Due to such onerous controls on international trade, Indian industries did not have access to superior technologies from developed countries. Lack of competition and huge government subsidies created an 'unchallenged' environment making the overall manufacturing sector largely inefficient. The products were of poor quality. The lack of technology and competition coupled with stringent government regulations left the industries unmotivated for improvement. The policy of import substitution did allow India to build a diversified manufacturing sector but it also led to misallocation of resources and is blamed for the stagnation of the manufacturing sector in the 1960s (Kulkarni and Meister, 2008 and Gupta, et al., 2008). The Total Factor Productivity (TFP) grew at a rate below 1% during 1960s and then the country experienced a negative TFP growth during the period 1970-80.

By contrast, the East Asian economies adopted a policy of export-led industrialisation and experienced rapid growth. Their success cast a doubt on the effectiveness of the policies such as import substitution and developing countries were almost always recommended to follow the East Asian model of growth (Veeramani, 2012). During the late-1970s and early-1980s, a few measures of liberalisation were adopted by India to liberalise the regime. This included deregulation and delicensing in certain industries, thus according a greater role to the private sector. This process of liberalisation greatly accelerated after 1991 following a severe balance of payments crisis. The crisis compelled India to undertake a series of industrial and trade reforms. According to Ahluwalia (1995), the changes that the reforms after 1991 brought in were “fundamental” in nature compared to the “marginal” changes in the previous decade.

Under these reforms, the trade regime was drastically modified by introducing reduction in tariffs, a removal of quantitative restrictions on imported inputs and capital goods for export production and elimination of public sector monopoly on imports of all items except petroleum, edible oils, and fertilizer and certain items canalised for health and security reasons. The government’s export-import policy plan (1992–97) reduced the role of the import and export control system considerably. The share of products subject to quantitative restrictions decreased from 87% in 1987-88 to 45% in 1994-95. Restrictions on exports were also relaxed, with the number of restricted items falling from 439 in March 1990 to 210 in March 1994. Furthermore, the average tariffs fell from more than 80% in 1990 to 39% by 1996.

All these reforms were carried out in order to make the Indian industry more efficient, technologically up-to-date and competitive to achieve rapid growth. No doubt, India grew quite fast during the post-1991 period following the reforms. However, it has been a growth led mainly by the fast expansion of the services sector. Some of the sub-sectors of manufacturing, which did well during this period, were mainly capital-intensive industries and not the labour-intensive ones. Overall, the manufacturing sector of India is yet to take off. This is contrary to the evidence from other emerging countries such as China where manufacturing has been the main contributor to the fast economic growth. As shown in Table 4.1, the manufacturing sector share in total GDP, in spite of the widespread reforms, remained more or less stagnant for the past three decades.

Table 4.1: Sectoral shares in GDP

Year	**Agriculture, value added (% of GDP)**	**Manufacturing, value added (% of GDP)**	**Services, value added (% of GDP)**
1980	35.4	16.2	40.3
1990	29.0	16.2	44.5
2000	23.1	15.4	50.8
2010	17.7	14.5	55.1

Source: World Development Indicators, 2011.

Trade Openness and Services Sector of India

Many authors argue that the fundamentals of trade in services are no different to that of trade in goods and that liberalisation of trade in the services industries generates benefits even for the goods sector too. Liberalising trade increases the efficiency of the difference sub-sectors in the services industry and, in turn, leads to improved growth performance. As Mattoo et al. (2001) discuss, an efficient financial services sector leads to an efficient transformation of savings to investment by ensuring that resources are deployed where they have the highest returns. Improved efficiency in the telecommunications sector generates economy-wide benefits because telecommunications are a vital intermediate input and are also crucial to the dissemination and diffusion of knowledge (the benefits of the spread of the internet around the world bears testimony to the importance of telecommunications services). Similarly, an efficient transport services sector can contribute to faster distribution of goods and significantly enhance the ability of a country to participate in international trade. Liberalisation of services trade also helps deepening ‘fragmentation’ of production (Deardorff, 2001). As seen increasingly in recent times, technology permits production to be fragmented across countries-with one country designing the product and the final product being produced in another country where labour is comparatively cheaper. Fragmentation may require additional inputs of internationally provided services. If those services are unavailable due to trade barriers then fragmentation will not occur. Thus, trade liberalisation in services can help create jobs, generate foreign exchange and contribute towards GDP growth. Services exports can be part of development strategy of developing countries. One prime example in this context can be the rapid increase in India's IT exports. India, with its vast pool of educated workers, has been a major destination for outsourcing of IT-related work because, with the falling barriers to trade in services, foreign firms have increasingly outsourced work to countries where administrative costs are much lower (Cali et al., 2008). Even, services imports can be beneficial for developing countries where the domestic services industry is inefficient. Opening up the market to foreign service providers will increase consumer welfare, encourage competition and make the domestic providers more efficient in the medium and long run. Thus, liberalisation may bring in the much needed capital in the economy which may also stimulate investment in infrastructure development which, in turn, will also benefit the merchandise sector.

The post-liberalisation era performance of India is characterised by the rapid growth of its services sector, with the growth rate increasing progressively since the 1980s (see Table 4.2). During the post-1980 period, the GDP growth rate accelerated and many studies show that it is the services sector growth which is driving the overall growth of the Indian economy.

Table 4.2: Decadal Growth Rate of GDP, aggregate and by sector

Year	Agriculture (%)	Manufacturing (%)	Services (%)	Aggregate GDP (%)
1980-89	2.99	5.71	5.96	4.99
1990-99	2.77	5.23	6.93	5.18
2000-10	2.92	7.38	8.22	6.81

Source: Author's own calculations based on data from World Development Indicators, 2012.

The empirical literature says that as an economy grows, both demand and supply side factors operate which may lead to growth in the economy's service sector (Gordon and Gupta, 2004andBanga, 2005). On the demand side, structural changes in the manufacturing sector may lead to outsourcing of certain operations such as legal and security operations to service sector which were previously done by the manufacturing firms themselves. Supply side factors include trade liberalisation, foreign direct investment and technological advancement.

If we look at the sectoral shares of India's trade (Table 4.3) the picture that we see is quite similar to that observed in Table 4.1. Share of services exports in total exports increased by about 20 percentage points between 1990 and 2010 whereas shares of both agricultural and manufacturing exports declined during the same time. Even though the manufacturing goods are the highest traded components in terms of share in total exports it showed some growth immediately after the 1991 liberalisation but then went on reducing persistently. An overall similar pattern is observed when we look at the components of total imports as well (Table 4.4) with share of services imports in total imports increasing over time and the other two sectors exhibiting a declining trend in terms of their respective shares.

Table 4.3: Sectoral shares in total exports

Year	**Agriculture**	**Manufacturing**	**Services**
1990	0.04	0.70	0.26
1995	0.01	0.76	0.23
2000	0.01	0.67	0.32
2005	0.01	0.57	0.42
2010	0.02	0.52	0.46

Source: Author's own calculations based on data from World Development Indicators, 2012.

Table 4.4: Sectoral shares in total imports

Year	Agriculture	Manufacturing	Services
1990	0.05	0.64	0.31
1995	0.05	0.62	0.33
2000	0.04	0.54	0.42
2005	0.02	0.60	0.38
2010	0.02	0.59	0.39

Source: Author's own calculations based on data from World Development Indicators, 2012.

Previously, quite a few empirical studies have tried to assess the link between trade openness and services sector growth. Given the scope of the study, I discuss only the directly relevant Indian papers here. Gordon and Gupta (2004) use panel model analysis and show that the sub-sectors (within services sector) which were open to external trade grew faster. Banga and Goldar (2004) use multiple regression analysis and find that the rapid growth of use of services in manufacturing was mainly due to the trade reforms undertaken during the 1990s. Eichengreen and Gupta (2011) investigate the determinants of India's services sector growth and finds that trade liberalisation affects the growth of services positively. There is however another set of literature which says that it is the productivity growth during the 1980s which accelerated the growth of the economy (Rodrik and Subramaniam, 2004). Verma (2006) finds that it is primarily the productivity growth which is causing the services sector to grow so fast, as opposed to trade liberalisation. Goldar and Mitra (2008) also report similar findings.

In this context, I try to examine the link between trade openness and sectoral GDP growth for all the three sectors. The rest of the study is structured as follows. Section 4.1.2 outlines the econometric model, Section 4.1.3 presents the results and Section 4.1.4 concludes. Then, we move on to the next disaggregated level analysis where I assess the effects of trade openness on manufacturing growth at the Indian state-level in Chapter 4.2.

4.1.2 Model Formulation

The econometric model used to estimate the empirical relationship between agricultural, manufacturing and services GDP and trade openness are outlined in Equations 1, 2 and 4 respectively. Selection of variables has been done following a thorough review of the existing literature. All data sources are given in the Appendix. Before I discuss the estimating equations, a clarification of the measures of trade openness used in this analysis is important. I had used measures of both trade volumes and trade barriers as proxy for trade openness in Chapter 3. I had used two measures of trade barriers-total taxes on international trade and KOF Globalisation Index based on various types of trade barriers such as tariffs and customs tax. However, trade barriers could not be used as proxy in the sectoral level analysis because data on measures of trade barriers are available only at the aggregate or country level. For instance, the KOF index is constructed on the basis of aggregate level data and the other measure of barriers used in Chapter 3 was 'Tax' which is total taxes on all international trade (i.e. a measure constructed using aggregate data). The only sector, for which, creating a separate trade barriers index was possible is the manufacturing sector using industry-specific data. I created one for the Indian states and the measure will be discussed in Chapter 4.2.

Hence, in this chapter (4.1), I use only measures of trade volumes as proxy for openness. The proxies used are sectoral trade share in aggregate GDP. For example, the trade openness measure used in the examination of Agricultural sector growth performance and trade openness link is agricultural trade as percentage of total GDP ('atrade'). Similar measures are used for the other two sectors as well.

The estimating equation used for the empirical examination of effects of trade openness on the Indian agricultural sector is expressed as the following:

$$LAGDP_t=\beta_0 + \beta_1 LAGDP_{t-1} + \beta_2 Latrade_t + \beta_3 Lcredit_t + \beta_4 Lirrigation_t + \beta_5 Acapital_t + \beta_6 fertilizers_t + \beta_7 TOT_t + \beta_8 Lrainfall_t + \beta_9 dummy91 + \beta_{10} trend + e_t \quad (1)$$

where, ‘AGDP’ is defined as Agricultural GDP at factor cost (in INR billion, constant prices 2004-05), ‘atrade’ is agricultural trade (% of aggregate GDP), ‘credit’ stands for direct institutional (both short and long term) credit to agriculture by Scheduled Commercial banks and Regional rural banks, ‘irrigation’ is irrigated land (% of total agricultural area), ‘Acapital’ is gross capital formation in agriculture(as % of GDP) at 1993-94 prices, ‘fertilizers’ is defined as fertilizers in tonnes per hectares of agricultural area, ‘TOT’ is terms of trade (the ratio of agricultural prices to industrial prices)[26] and, finally, ‘rainfall’ stands for All India Rainfall during June to September.

All variables are expressed in their natural logarithms apart from capital formation, fertilizers and terms of trade because the values of these three variables lie between 0 and 1. The model includes a lagged dependent variable as an explanatory variable to take account of any feedback or autoregressive effect. I also include a period dummy (dummy91) in the model which takes the value of 1 if the year is 1991 onwards and 0 otherwise. The aim behind the inclusion of the dummy variable is to check whether there has been any change in the performance of the agricultural sector after 1991 when India started to adopt widespread trade reforms.

The theoretical framework for the econometric model for determinants of manufacturing GDP comes from the Mankiw et al. (1992) or Augmented Solow model which has been described in Chapter 3. The econometric model can be expressed as follows.

$$LMGDP_t = \beta_0 + \beta_1 Lcapital_t + \beta_2 Lsenrol_t + \beta_3 Llabour_t + \beta_4 Lmtrade_t + u_t \quad (2)$$

[26]Terms of trade between agricultural and non-agricultural sectors can be defined as ratio of agricultural prices to industrial prices. A rise in the ratio (agricultural prices divided by industrial prices) means that the agricultural sector is better off in terms of its purchasing power of industrial goods. So we would hypothesise that an increase in terms of trade should positively affect the growth of the agricultural sector.

where, ‘MGDP’ is Manufacturing GDP at factor cost (in INR billion, constant prices 2004-05), ‘Senrol’ is secondary school enrolment (as % of population aged 15 and over)[27], ‘capital’ stands for gross fixed capital formation (as % of GDP), ‘labour’ is number of workers in registered manufacturing[28] and, finally, ‘mtrade’ is defined as manufacturing trade (% of GDP).

However, a study of the related empirical literature suggests that there are also other factors (or policies) which affect the performance of the manufacturing sector of a country. For example, empirical evidence suggests that, the more flexible the labour markets, the faster will be the growth of industries. In other words, entrepreneurs prefer to invest in economies where the labour laws are less rigid and hiring or firing employees is more flexible. Physical infrastructure (such as road and rail networks) is another useful explanatory variable in the context of manufacturing sector growth which outlines how convenient it is for the industries to transport their final goods to the destinations or ports. Good infrastructural facilities also make it easier to ship the required intermediate goods to the manufacturing plants and factories. Furthermore, access to credit is necessary for investment. So many previous studies found that development of financial markets positively affects industrial production. Given the issues discussed above, I extend the econometric model by including road density (total road network divided by the land area), man-days lost due to strikes and lock-outs and industrial credit (credit by scheduled commercial banks to small, medium and large industries) as proxy for physical infrastructure, labour market rigidity and access to credit (or, development of financial markets) respectively. The augmented model (with all the variables in logs) looks as follows.

[27] Many existing empirical studies working on manufacturing performance usually consider secondary school enrolment as a proxy for human capital.
[28] Data on employment in unregistered manufacturing is not available.

$$LMGDP_t = \beta_0 + \beta_1 LMGDP_{t-1} + \beta_2 Lcapital_t + \beta_3 Lsenrol_t + \beta_4 Llabour_t + \beta_5 Lmtrade_t + \beta_6 Lroad_t + \beta_7 Llmr_t + \beta_8 Lcredit_t + \beta_9 dummy91 + \beta_{10} trend + u_t \quad (3)$$

where, 'road' stands for road density (total road network divided by the land area), 'lmr' is labour market rigidity (man-days lost due to strikes and lock-outs) and 'credit' is access to credit (credit by scheduled commercial banks to small, medium and large industries).

Finally, I specify the model used for examination of the link between services GDP and trade openness which is presented below.

$$LSGDP_t=\beta_0+\beta_1 LSGDP_{t-1}+ \beta_2 Lstrade_t+ \beta_3 Ltenrol_t+ \beta_4 LCGDP_t+ \beta_5 Lindustries_t+ \beta_6 dummy91+ \beta_7 trend + e_t \quad (4)$$

where, 'SGSP' is Services GDP at factor cost (in INR billion, constant prices 2004-05) and 'strade' stands for trade in services (as % of GDP). Service sector generally involves high-skilled work thus the human capital stock of the economy may act as an important determinant of this sector's growth. I use tertiary school enrolment ('tenrol', defined as percentage of population above 20 enrolled in tertiary education) as a proxy for human capital. A measure of the aggregate GDP per capita (CGDP) has also been incorporated in the model because as income of people goes up they demand more services which leads to an expansion in the services sector. Growth of industries may consequently increase the growth of service sector in the form of outsourced work from the former to the latter. Hence, size of the manufacturing sector, 'industries', has been included. All variables are expressed in their natural logarithms. A logged dependent variable is included to see whether past growth rates determine the present growth rate of the service sector.

Some studies also use urbanisation rate as an explanatory variable for the service sector growth on presumption that it is predominantly the urban population which demands services. However, in India's case, urbanisation rate (defined as urban population as % of total population) has been very slow. Nonetheless, I initially included a proxy for urban growth in my model. The variable came out to be statistically insignificant and it was further observed that exclusion of this variable does not change the results (fit of the regression and sign, magnitude and significance of other explanatory variables). Consequently, the variable was dropped from the estimating model. Econometric results obtained after estimation of equations 1, 3 and 4 are presented in the following section.

4.1.3 Results and Discussion

I start by estimating the relationship for agriculture and then I estimate those of manufacturing and services respectively. The ADF test has been conducted to find the order of integration of my variables.

Agriculture

Table 4.5: ADF test results with trend and intercept

Variable	Level	First Difference	Conclusion
LAGDP	-3.83**		I(0)
Latrade	-0.64	-4.80***	I(1)
Lcredit	-.61	-3.19*	I(1)
Lirrigation	-3.33*		I(0)
Acapital	-1.99	-3.62**	I(1)
fertilizer	-1.83	-3.17*	I(1)

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% respectively. AGDP comes out to be trend-stationary.

Agricultural trade, credit, capital formation and fertilizer are all I(1) i.e. they are stationary in first differences. So I will try to model a growth equation which looks as follows.

$$\Delta LAGDP_t=\beta_0+\beta_1\Delta LAGDP_{t-1}+\beta_2\Delta Latrade_t+\beta_3\Delta Lcredit_t+\beta_4\Delta Lirrigation_t+\beta_5\Delta Acapital_t+ \beta_6\Delta Fertilizers_t+\beta_7 TOT_t+\beta_8 Lrainfall_t+\beta_9 dummy91+ \beta_{10} trend + e_t \quad (5)$$

I employ Ordinary Least Squares (OLS) method to estimate the relationship. If any evidence of serial correlation is found then the model is re-estimated using Generalized Least Squares

(GLS). In presence of autocorrelated errors, I use the Prais-Winsten estimation method and not the Cochrane-Orcutt procedure because the former, unlike the latter, retains the information from the first observation which is important particularly in the case of small samples. The regression results are given in Table 4.6.

Table 4.6: OLS and GLS Estimation Results, Agricultural sector

Independent Variable	**Coefficient (OLS) 1975-2008**	**Coefficient (OLS) 1982-2006**	**Coefficients (Prais-Winsten Regression) 1982-2006**
$\Delta LAGDP_{t-1}$		-0.47***	-0.44***
$\Delta Latrade_t$	-0.12*	-0.02	-0.002
$\Delta Lcredit_t$		0.03	-0.02
$\Delta Lirrigation_t$		0.02	0.01
$\Delta Acapital_t$		-1.34	-1.25*
$\Delta fertilizer_t$		0.34	0.01
TOT_t		-0.01	-.01
$Lrainfall_t$		0.42***	0.41***
dummy91		0.03	.04
cons	0.03	-2.31***	-2.22***
	R^2=0.12	R^2=0.83 **Ramsey Reset Test** H_0:no omitted variables P-value=0.89 **Breusch-Godfrey LM test for autocorrelation** H_0: no serial correlation P-value=0.11 **Test of Joint Significance** H_0: All explanatory variables (apart from rainfall and lagged dependent variable) are jointly zero. P-value=0.31	R^2=0.77 rho=-0.39

Note: Dependent variable is ΔLAGDP. Heteroskedasticity robust standard errors have been used. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively. Initially a trend variable was included but it came out to be statistically insignificant. Hence it was dropped from the model.

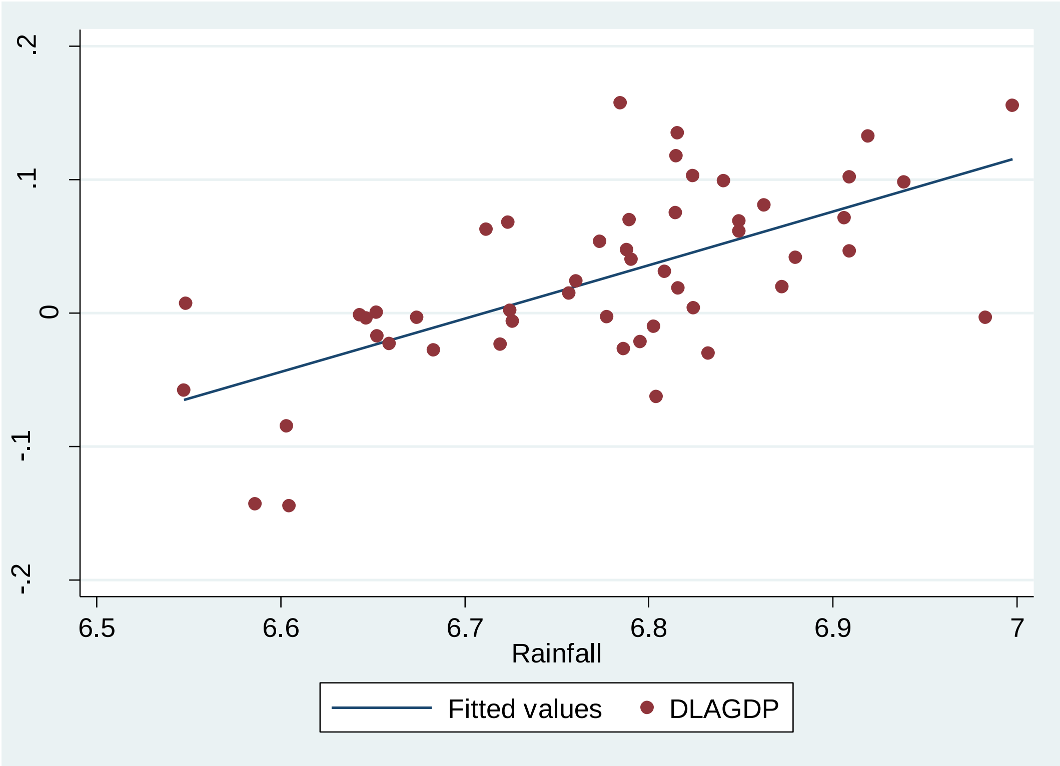
I started by estimating a gross relationship between trade and agricultural sector GDP and found that an increase in agricultural trade openness (ΔLatrade) negatively affects the growth rate of the agricultural sector in India (Column 1). If agricultural trade openness share goes up by 1 percentage point Agricultural GDP growth rate declines by 0.12 percentage points. However, the result is sensitive to model specifications. Next, I estimated the fully specified model for the time period 1982-2006. Other years could not be included because of lack of data on terms of trade.[29] The significance of the (negative) effect of trade on growth disappears when the fully specified model is estimated. Rainfall comes out as the only significant determinant of agricultural growth. The general findings are upheld when we estimate our econometric model using Prais-Winsten method (Column IV). Overall, I find no evidence that trade openness positively affects agricultural growth in India. The results stay unaltered even when I use other proxies for trade openness such as agricultural raw material imports (as percentage of merchandise imports) and re-assess the model for the time period 1962 to 2010 (Results are given in Table A4.2 in the Appendix). The main finding from this exercise is that monsoon cycles dominate the performance of the agricultural sector in India.

The trade and industrial reforms undertaken since 1991 should ideally have favoured the agriculture. Previously there was a policy bias against agriculture in the form of artificially low output prices and subsidized input prices. The decline in protection of the industrial sector should have tilted the terms of trade in favour of agriculture. Further, trade liberalisation should have erased the difference between domestic prices and international prices thus encouraging more investments to come into agriculture eventually leading to higher growth. The macro-economic stabilisation programme, after the BOP crisis in 1991, which included the depreciation of the exchange rate, should have led to an increase in export of agricultural goods thus leading to higher growth. But the econometric results suggest that none of those have happened. Hence, it may be the case that the sector failed to take advantage of trade reforms because of lack of reforms in other areas. It seems that agriculture in India still depends on the rainfall which reflects the lack of irrigation facilities across the

[29] It should be noted that even when I drop the terms of trade variable and reassess the model for a longer time period, the results stay unaltered, with rainfall being the only contributing factor to growth in agricultural sector.

country. Figure 4.1 below presents a scatterplot where growth rate of Agricultural GDP is the Y variable and Rainfall is the X variable. The plot clearly shows that there is a strong positive correlation between the two variables.

Figure 4.1: Agricultural GDP growth rate and Annual Rainfall Scatterplot



Source: Author's own calculations based on data from RBI and Indian Meteorological Department.
Note: Both the variables are expressed in their natural logarithms. DLAGDP is growth rate in Agricultural GDP.

As mentioned previously, even in 2009, almost 68% of the agricultural area still depended on rainfall. Here the government has to assume responsibility and public investment has to step up to deal with this problem. In fact, India's level of coverage of agricultural area by irrigation is low even by international standards. Furthermore, implementation is also an issue (Balakrishnan et al., 2008 and Kakarlapudi, 2010). For example, ongoing irrigation projects are delayed due to inadequate allocation of funds. So the governance also needs to be improved. Productivity of the agricultural lands in India is also going down because of the intensive use of pesticides and fertilizers (Vakulabharanam et al., 2007). A plausible solution to this problem can be adoption of superior technology and better inputs where India seriously lacks at the moment with continuing under-expenditure by the state on R&D in agriculture. Trade openness alone cannot induce growth in agriculture unless it is complemented by other policies such as investment in infrastructure (such as irrigation) and institutional reforms.

Manufacturing

The ADF test results indicate that all the variables in Equation 3 are I(1) except 'Llabour'. The OLS and GLS estimation results are presented in Table 3.8.

Table 4.7: ADF test results with trend and intercept

Variable	Level	First Difference	Conclusion
LMGDP	-1.15	-5.60***	I(1)
Lmtrade	-1.64	-3.17***	I(1)
Lsenrol	-1.07	-4.28***	I(1)
Lroad	-2.35	-2.60*	I(1)
Llmr	-1.82	-4.28***	I(1)
Lcapital	-2.29	-3.25*	I(1)
LCredit	-1.87	-3.39*	I(1)
Llabour	-3.52***		I(0)

Note: *, ** and *** represent statistical significance at 10%, 5% and 1% respectively.

Table 4.8: OLS and GLS Estimation Results, Manufacturing sector

Independent Variable	**Coefficients (OLS Regression) 1971-2008**	**Coefficients (OLS Regression) 1971-2008**	**Coefficients (Prais-Winsten Regression) 1971-2008**
$\Delta LMGDP_{t-1}$			0.42**
ΔLmtrade	-0.04	-0.06	-0.07
ΔLsenrol		-0.16	-0.09
ΔLcapital		0.15	-0.22
ΔLlabour		0.28*	0.36**
ΔLroad			0.09
ΔLlmr			-0.18*
ΔLCredit			0.21*
dummy91		0.01	-0.00
con	0.06***	0.05***	0.00
	R^2=0.01	R^2=0.24 **Ramsey Reset Test** H_0:no omitted variables P-value=0.31 **Breusch-Godfrey LM test for autocorrelation** H_0: no serial correlation P-value=0.69	R^2=0.75 rho=-0.42

Note: Dependent variable is ΔLMGDP. Heteroskedasticity robust standard errors have been used. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

We do not find any evidence that trade openness affects growth in case of Indian manufacturing. The dummy variable is insignificant throughout indicating the fact that there has been no trend break in manufacturing growth despite widespread industrial and trade reforms since 1991. Labour market rigidities and access to financial markets, proxied by ‘lmr’ and ‘credit’ respectively, seem to affect industrial performance in India. Both the variables have come out to be statistically significant with correct signs. Hypothetically speaking, increase in labour disputes will result in locks and strike-outs thus hampering industrial production. This premise seems to get some support from our analysis. Similarly, as expected, I observe that, the easier it is to access industrial credit the faster gets the manufacturing growth rate.

The endogeneity test[30] done after the two-stage GMM estimation method (see Table 4.9 below) indicates that our model does not suffer from any endogeneity bias. The test was conducted to make sure that there is no reverse causality from growth towards trade openness. It is also possible that once a country grows it invests more in the development of infrastructure and attracts more physical capital. In that case, the variables, ‘Lroad’ and ‘Lcapital’ will be biased. Similarly, higher economic growth enables a government to generate more revenues which, in turn, may result in higher expenditure in education leading to an increase in enrolment. In that case, ‘Lsenrol’ can be biased too.

Table 4.9: Endogeneity Test after 2-step GMM Estimation

Regressors tested (I)	**Regressors tested (II)**
H_0:Specified endogenous regressors can be treated as exogenous	
ΔLmtrade	ΔLmtrade, ΔLroad, ΔLcapital and ΔLsenrol
P-value=0.91	P-value=0.65

Note: Dependent variable is ΔLMGDP. A lagged dependent variable was included in the model. Regression output is not displayed here. Heteroskedasticity robust standard errors have been used. In Column (I), a gross relationship between ΔLMGDP and ΔLmtrade was estimated using GMM technique. In case of (II), the fully-specified model was run.

In Column I, I test for endogeneity of ‘mtrade’ and, in Column II, I present the result of joint endogeneity test of all the potential endogenous variables. The test results suggest thatour model does not suffer from any endogeneity bias. Finally, sometimes impact of liberalisation and that of other factors (such as infrastructure and credit) may come with a lag and may not have an instantaneous effect. For example, a better access to credit enables entrepreneurs to increase their industrial investments and it is quite possible that the returns (in form of increase in production, as a result) may start to come with a lag. Similarly, improving infrastructure (such as, building a road) may not always have real-time effects. One way of

[30] The test statistic is distributed as chi-squared with degrees of freedom equal to the number of regressors tested. It is like the C statistic and defined as the difference of two Sargan-Hansen statistics: one for the equation where the suspect regressors are treated as endogenous and the other for the equation where the suspect regressors are treated as exogenous (Hayashi, 2000).

modelling these issues is to include lagged values of the explanatory variables in the model. So, I re-examine the model using lagged values of trade, capital formation and road density.

Table 4.10: Estimation with lagged explanatory variables, Manufacturing sector

Independent Variable	**Coefficients (Prais-Winsten Regression) 1971-2008**
$\Delta LMGDP_{t-1}$	0.66***
$\Delta Lmtrade_{t-1}$	-0.06
$\Delta Lsenrol_{t}$	-0.25
$\Delta Lcapital_{t-1}$	0.17
$\Delta Llabour_{t}$	0.04
$\Delta Lroad_{t-1}$	0.36***
$\Delta Llmr_{t}$	-0.37***
$\Delta LCredit_{t-1}$	0.25***
Dummy91	-0.02*
constant	-0.04**
	R^2=0.92 rho=-0.72

Note: Heteroskedasticity robust standard errors have been used. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

1 percentage point increase in the growth rate of MGDP in the previous year ensures 0.66 percentage point increase in the growth rate of the same in the current year. Overall, the predictive capability of the regression equation goes up when we used one year lagged values of infrastructure, manufacturing trade openness, access to credit and capital formation. Now, infrastruture (proxied by road density) comes out to be statistically significant which supports the assertion that developmental effects of infrastructure development come with a time lag (1 percentage point increase in 'Lroad' in the past year accelerates MGDP growth rate by 0.36 percentage point in the current year). This variable was insignificant in the previous estimation (Table 4.8). We still do not find any evidence of an empirical relation between trade and growth in case of Indian manufacturing for the time period 1971-2008.[31] This finding seems to be robust and not sensitive to different econometric methods and model specifications. I estimated the relationship using another measure of manufacturing trade

[31] Other years could not be included due to data limitations of some variables in my model.

openness (merchandise trade as % of GDP)[32] but the results stayed unchanged (see Table A4.3 in the Appendix). Furthermore, since both manufacturing GDP and manufacturing trade are I(1) variables so I also examined whether there exists any long run relationship between the two variables by employing Johansen cointegration test. We wanted to see whether there is any evidence of dynamic gains from trade which can only be felt in the long run. For example, opening up to trade may give access to superior intermediate goods and transfer to technology. So if trade has actually benefitted the Indian manufacturing via these two channels then we believe that there should be a long run relationship. However, the Johansen test result suggests that there is no long run relationship between the two. So, I do not report those results here.

Probably, two reasons can be given why I do not find a significant relationship between trade openness and manufacturing growth. Firstly, some previous studies (such as Gupta et al., 2008; Gupta and Kumar, 2010) have observed that it is the crumbling infrastructure and lack of reforms in the financial markets which are holding back Indian manufacturing from taking advantage of the trade reforms undertaken since 1991. Secondly, when a country opens up, forces of comparative advantage reallocates the resources, by channelising the factors of production into the sectors where the country has a comparative advantage. Employment rises in those factors and falls in the import-substituting sectors. However, this re-structuring of the industrial sector could not happen in India because of rigid labour laws. Probably that is why we do not see any short-run or long-run impact of trade on industrial growth.

However, it should be noted that the performance of the manufacturing sector has been heterogeneous across Indian states and across sub-sectors (registered and unregistered

[32]This measure is, though, less accurate than the one originally used in the analysis because merchandise trade includes some items of the agriculture also and hence there is a chance of overlapping of the two sectors. I still use it because then we can test the relationship for a longer time period (1962-2011).

sectors). So, I will once again examine this relationship at the Indian state level in the following sub-chapter.

Services

Estimation of the Equation 4 for the time period 1975-2010 indicates that trade openness does not have any impact on services sector growth. However, the dynamics of the relationship changes during the post-reform period. We find that an increase in growth rate of services trade affects service sector growth rate positively during the post reform period (after 1991).

Table 4.11: OLS and GLS Estimation Results, Services sector

Independent Variable	**Coefficients (OLS Regression) 1991-2010**	**Coefficients (Prais-Winsten Regression) 1991-2010**
Δ $LSGDP_{t-1}$	-0.17	0.05
$\Delta Lstrade_t$	0.03	0.03**
$\Delta LCGDP_t$	0.69***	0.85***
$\Delta Ltenrol_t$	0.67**	0.22
$\Delta Lindustries_t$	-0.05	-0.13
constant	0.05***	.04***
	R^2=0.65 **Ramsey Reset Test** H_0:no omitted variables P-value=0.97 **Breusch-Godfrey LM test for autocorrelation** H_0: no serial correlation P-value=0.01	R^2=0.96 rho=-0.82

Note: Dependent Variable= ΔLSGDP. The trend variable was not significant and hence dropped. Since we found evidence of serial correlation so we are not drawing any conclusion from the OLS regression results. Heteroskedasticity robust standard errors have been used. *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

If the growth rate of services trade share increases by 1 percentage point then we would expect the services sector growth rate to accelerate by 0.03 percentage points. When the growth rate of per capita GDP increases by 1 percentage point it makes the services sector growth accelerate by 0.85 percentage points. This is understandable because as the economy grows people demand more services and this, in turn, leads to an expansion of the services sector. The effect of trade openness does not show up in the OLS estimation. However, these results suffer from the problem of autocorrelation and hence the Prais-Winsten estimates should be used to draw any inference. The finding, that trade openness has affected service sector growth positively, is not a new revelation in itself and has already been established by the findings of previous studies on the Indian services sector. The main contribution of the examination of services sector performance and trade openness in this study has been to identify the exact time from when trade openness started to affect services sector performance (post-1991 period). I did a similar exercise for both manufacturing and agricultural sectors as well (by introducing a period dummy in 1991) to look for the impact of trade openness during the post reform period. But it does not seem that relationship between trade openness and agriculture or manufacturing sector underwent any change after the adoption of liberalisation measures. In this context, I would also like to remind the reader that the main objective of this chapter is to examine the relationship between trade openness and manufacturing performance of India because, as stated earlier, the trade reforms and the other economic liberalisation programmes undertaken in the 1980s and 1990s were specifically aimed to boost the manufacturing sector. That is why, I re-examine the trade-manufacturing growth nexus in Chapter 4.2 using disaggregated level data.

4.1.4 Conclusion

The aim of this study was to examine the empirical relationship between sectoral GDP growth and sectoral trade openness using time series econometric methods. The econometric results indicate that the effect of trade openness is heterogeneous across sectors. Whereas, service sector performance has been affected by trade openness, no econometric evidence was found to claim that the same is true for agriculture and manufacturing sectors. It seems that agricultural sector performance in India still depends on the monsoon cycles because the explanatory variable, amount of rainfall per year, seems to be the most robust determinant of agricultural GDP growth. This hints towards the lack of public investment in the irrigation system of the country. The sector also seems to suffer from gross misallocation of resources. That is why, the variables such as agricultural capital formation and fertilizers have no significant growth effects. In short, trade openness alone cannot induce growth in agriculture unless it is complemented by other policies such as investment in infrastructure (such as irrigation) and institutional reforms.

The overall manufacturing sector has also been underperforming even though substantial industrial and trade reforms have been undertaken during the last three decades. There are two main reasons why no significant relationship is observed at the sectoral level. Firstly, many past studies have asserted that it is India's crumbling infrastructure which is holding the manufacturing sector back. Secondly, the labour market rigidities are to be blamed for such dismal performance. When a country opens up, forces of comparative advantage reallocates the resources, by channelising the factors of production into the sectors where the country has a comparative advantage. Employment rises in those factors and falls in the import-substituting sectors. However, this re-structuring of the industrial sector, especially the registered segment, could not happen in India because of rigid labour laws. Probably that is why we do not see any impact of trade openness on industrial growth. This assertion gets further support from my findings in the next sub-chapter 4.2 where I reinvestigate for the relationship at the state level.

Only the services sector GDP seems to experience a trend break after the 1991 trade reforms. The sector experienced faster growth after 1991 and trade openness also seemed to affect growth after 1991. I did not find any evidence of effects of trade on service sector growth when the estimation was conducted for the time period 1975-2010. However, the dynamics of the relationship changed after 1991 when, as a result of increasing trade openness, the sector's growth rate accelerated. This finding is consistent with past studies such as Gordon and Gupta (2004) and Eichengreen and Gupta (2011).

Chapter 4.2: Does trade openness affect manufacturing growth at the Indian state level?

4.2.1 Introduction

The picture of stagnancy of Indian manufacturing that we see at the aggregate level is not uniformly true at the state level. As seen from Table 4.12, there is significant variation in the share of manufacturing in the State domestic product (SDP) across the Indian states. There have been some states, such as Gujarat and Maharashtra, whose manufacturing share in SDP has consistently been higher than the other Indian states. The manufactures share in SDP for the 15 major states has actually fallen over time during the post-reform period. However, as mentioned previously, the performance has not been same across states. There are some such as Orissa, Rajasthan and Bihar who have actually experienced a growth in the share and on the other hand there are some such as Tamil Nadu and Kerala whose performance has been much worse when compared to the overall average decline of 2.1% in the share.

Table 4.12: Share of Manufacturing to SDP of Indian States

States	**1994-95**	**2004-05**	**Change**
Punjab	16	14.8	-1.3
Haryana	17.4	17.3	0.0
Rajasthan	18.3	18.9	0.5
Uttar Pradesh	18.4	16	-2.3
Bihar	20.4	21.8	1.3
Assam	18.9	16	-3.0
West Bengal	21.9	18.6	-3.2
Orissa	21.6	25.9	4.3
Madhya Pradesh	23.8	23.4	-0.4
Gujarat	30.6	28.1	-2.4
Maharashtra	28.1	22.6	-5.5
Andhra Pradesh	20.2	19.0	-1.2
Karnataka	23.3	20.4	-2.8
Kerala	19.2	15.3	-4.0
Tamil Nadu	29.3	20.9	-8.4
Average of 15 states	**20.5**	**18.4**	**-2.1**

Source: Kathuria and Raj (2010)

There are many empirical papers which investigate the main determinants of manufacturing growth in India. However, studies at the macro level will not be able to answer the question why some states outperformed others in terms of their performance in the manufacturing sector. In this study, I ask: Can trade openness explain some of the differences in the cross-state manufacturing performance?

I try to answer this question on the basis of manufacturing SDP growth performance of 22 states (including the new states-Jharkhand, Chhattisgarh and Uttarakhand) in a panel model framework for the time period 1988-2007. The states of Jharkhand, Chhattisgarh and Uttarakhand have been clubbed with their parent states-Bihar, Madhya Pradesh and Uttar Pradesh respectively in order to maintain consistency in the data for the entire sample period. This is because these new states were formed in 2000 and, as a result, no data is available for these states prior to that year. I control for all those factors in our econometric analysis which are considered to be important determinants of manufacturing growth. Labour market rigidities is a major factor which is holding back the Indian manufacturing sector and labour intensive industries in particular (see Gupta et al., 2008). Another major constraint has been the lack of proper infrastructure. Many researchers such as Panagariya (2004) argue that India's crumbling infrastructure is one of the factors which explain the difference in the manufacturing performance of India and China. The financial sector (access to credit) is another area where there has been little progress even in the post reforms period.[33] In addition, I also control for human capital because working in the manufacturing sector requires some level of education. Finally, a measure for trade openness has also been included in our econometric model to see whether more "open" states grow faster than the "closed" ones. To the best of my knowledge, this is one of the first studies to consider trade openness as one of the probable determinants of industrial sector growth.

[33] For further discussion on how credit constraint may have hindered expansion of small and medium-sized firms, see Nagaraj (2005).

The rest of the paper is organised as follows. Section 4.2.2 does a review of the related literature. Section 4.2.3 presents a descriptive analysis of the manufacturing performance of major Indian states. The econometric model is presented in Section 4.2.4 along with variable descriptions. Section 4.2.5 presents the econometric findings. Finally, Section 4.2.6 concludes with some policy implications.

4.2.2 Review of the Literature

As mentioned previously, the performance of the manufacturing sector is quite mixed if we look at the sub-national level. Some states have experienced substantial growth in the manufacturing sector during the post-reform period whereas some experienced almost no growth at all in spite of the fact that the macro level reforms were same for all the states. A few papers have studied the pattern of industrial development at the Indian sub-national level. The debate, whether inter-regional disparities have increased or decreased, largely remain inconclusive. Dhar and Sastry (1967) conduct a study on industrial growth for the time period 1951-61 and conclude that inter-state dispersion in industrial output has been declining.[34]Sarodamoni (1969) and Lahiri (1969) observe a similar trend. Awasthi (1991) studies the pattern of industrial growth of 17 major Indian states for the time period 1961-1978 and concludes that inter-state disparities have declined. On the other hand, there are many empirical studies which observe exactly the opposite picture. Nadkarni (1970), Jhuraney (1976) and Barathawal (1980) all show that inter-state disparity in industrial development has increased during the 1960s and 1970s. Some empirical papers relating to the post reform period also find that the inter-state disparities in industrial development are growing (Bhattacharya and Sakthivel, 2004 and Papola et al., 2011). Sarker and Das (2011) study the disparities of state-level manufacturing performance in India and say that the better performing states introduced better economic and administrative reforms during the reform

[34] They used industrial power consumption as a proxy for industrial output.

period compared to the laggard states and this is the main reason behind the formers' industrial growth. They point out some of the key areas, such as labour market problems, which may have caused the difference in the performance across states. For instance, West Bengal, one of the worst performers in manufacturing among Indian states, had the highest number of man-days lost due to lockout and strikes among all the states. Number of man-days lost in West Bengal was about 69% of all man days in India in 2005. On the other hand, all the better performing states experienced a substantial decline in the incidence of industrial disputes during the post reform period. In 2005, the combined man-days lost in Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Punjab and Haryana was only 7.75% of all man-days lost in India during that year. States with higher labour market rigidities are also less attractive for industrial investments (Panagariya, 2006). States such as Gujarat, Haryana, Maharashtra, Tamil Nadu and Karnataka have the highest incidence of per capita Foreign Direct Investment (FDI) during the time period 1991-2003. West Bengal and Kerala failed to attract FDI compared to the above mentioned states. Sarkar and Das (2011) argue that this is mainly due to the 'anti-imperialist' stand taken by the Communist Party governments in the latter states.

The difference in the quality of physical infrastructure between the better performing states and the so-called 'laggard' states is also quite understandable because infrastructure is a pre-requisite for industrial investment. Assam, Bihar, West Bengal and Uttar Pradesh record the most dismal performance among all states in regard to per capita electricity consumption and telephone lines per hundred people.[35] Chakravorty and Lall (2007) find evidence of "cumulative causation and divergence" i.e. industrial investments tend to go to states where there already exists a substantial industrial base. In other words, they find that the industrially advanced regions attract the new investments.

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[35] Kerala is an exception with regard to infrastructure. In spite of its slow growth in manufacturing, Kerala performs much better than the other poorly performing states. See Sarker and Das (2011) for more details.

As mentioned at the outset, one major limitation of the past studies is that none of them controlled for any openness measure in their analysis.[36] This study tries to fill that gap in the existing literature.

Some previous studies have found that the impact of the trade and industrial reforms have been different on registered and unregistered sectors of manufacturing (Rani and Unni, 2004). This is quite possible because there are some fundamental differences in characteristics of the two sub-sectors. The organised sector may have failed to take the advantage of the reforms because they have stringent labour regulations. However, these issues do not arise in case of unregistered manufacturing because it is an informal sector and the labour laws do not apply. I therefore also disaggregate the manufacturing sector into registered and unregistered sectors and try to assess the impact of trade openness on the two manufacturing sub-sectors separately.

In the next section, we look at the relative industrial performance of the states (in terms of the growth of manufacturing sector) in our sample and also try to see whether the states are converging or diverging in terms of their manufacturing performance. Though many studies have done this exercise yet re-doing it is important because, in the past, different papers have reached different conclusions on the convergence of Indian states in terms of manufacturing performance. The ambiguity is probably expected because they all use different time periods and most of them did not have enough years after the 1991 reforms to carry out this analysis.

4.2.3 Manufacturing Performance of Indian States-An Overview

In the post reform period, the general notion was that inter-state disparities grew wider and the richer states, on an average, grew faster than the laggard states. The state governments,

[36]Mitra and Ural (2008) is probably the only exception. They find that trade liberalisation benefits most the export-oriented industries located in states with flexible labour-market institutions and deregulation does not have a positive impact on industrial productivity in states with bad labour institutions.

which implemented a series of reforms within their own states, took advantage of those macro level economic reforms and registered more impressive manufacturing performance than the others. As we see in the Table 4.13, there is significant variability in manufacturing performance at the state-level.

Table 4.13: State-wise aggregate manufacturing GSDP growth (%)

States	1980-89	1990-99	2000-09
Andhra Pradesh	7.65	7.34	6.37
Assam	6.59	1.04	6.86
Bihar	6.93	-0.83	6.67
Delhi	8.67	7.12	7.17
Goa	8.15	10.47	4.18
Gujarat	8.23	11.65	9.41
Haryana	10.81	6.03	7.69
Himachal Pradesh	12.58	10.48	6.05
Karnataka	6.76	6.52	10.94
Kerala	2.87	6.14	4.6
Madhya Pradesh	5.89	7.99	1.2
Maharashtra	5.65	7.12	6.99
Meghalaya	5.78	1.7	17.31
Orissa	6.15	6.4	14.36
Punjab	8.98	8.3	5.15
Rajasthan	6.01	5.6	5.41
Tamil Nadu	3.52	4.22	5.28
Uttar Pradesh	9.95	3.12	6.03
West Bengal	3.11	5.63	3.97
Aggregate Average Growth	**5.95**	**7.03**	**8.5**

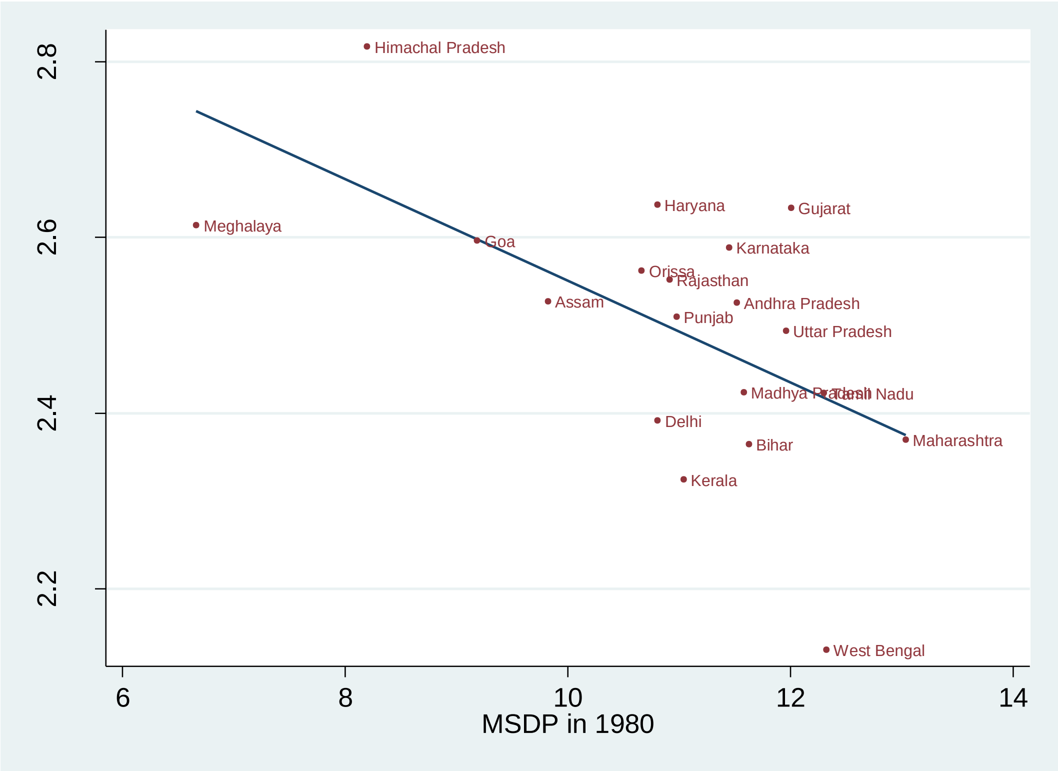
Source: Author’s own calculation using data from EPWRF.
Note: The new states of Jharkhand, Uttarakhand and Chhattisgarh have been clubbed with their parent states.

Among all the states, only Gujarat has performed better than the national average throughout the three decades. States such as Himachal Pradesh, Karnataka, Andhra Pradesh, Delhi and Haryana also maintained an impressive growth rate (a rate that is higher or at par with the national average) during this time period. States such as Kerala and West Bengal have been the consistent under-performers (growth in these 2 states has always been below the national average). Aggregate manufacturing growth in the previous decade (2000s) went up by around 1.5 percentage points compared to the 1990s. However, it is not the high performers such as Maharashtra, Andhra Pradesh or Gujarat which experienced a rise in growth to explain the acceleration in aggregate average growth in the 2000s. In fact, for most of the fast-growing states like Gujarat, Maharashtra, Goa, Punjab, Himachal Pradesh and Andhra Pradesh, the manufacturing performance worsened in the 2000s when compared to that during 1990s. Only Karnataka, Haryana and Tamil Nadu are the exceptions. It has been the hitherto “laggard” states such as Assam, Orissa, Bihar, Uttar Pradesh and Meghalaya which showed a sharp rise in their average growth rates during 2000-09.[37]

So if it is the case that there has been an acceleration in the manufacturing growth rate of the poorer states during the 2000s then it will be interesting to check whether the Convergence Hypothesis holds for the Indian states. According to the hypothesis, a poor state, other things equal, should grow faster than a rich state. We test the hypothesis for the time periods 1980-2007 and 1990-2007 respectively. We use manufacturing GSDP in 1980 and 1990 as the initial GSDP respectively. As Figures 4.2 and 4.3 suggest, we find some support for the fact that manufacturing sector in the poorer states are growing at a faster rate than that in the richer states during the last two decades.

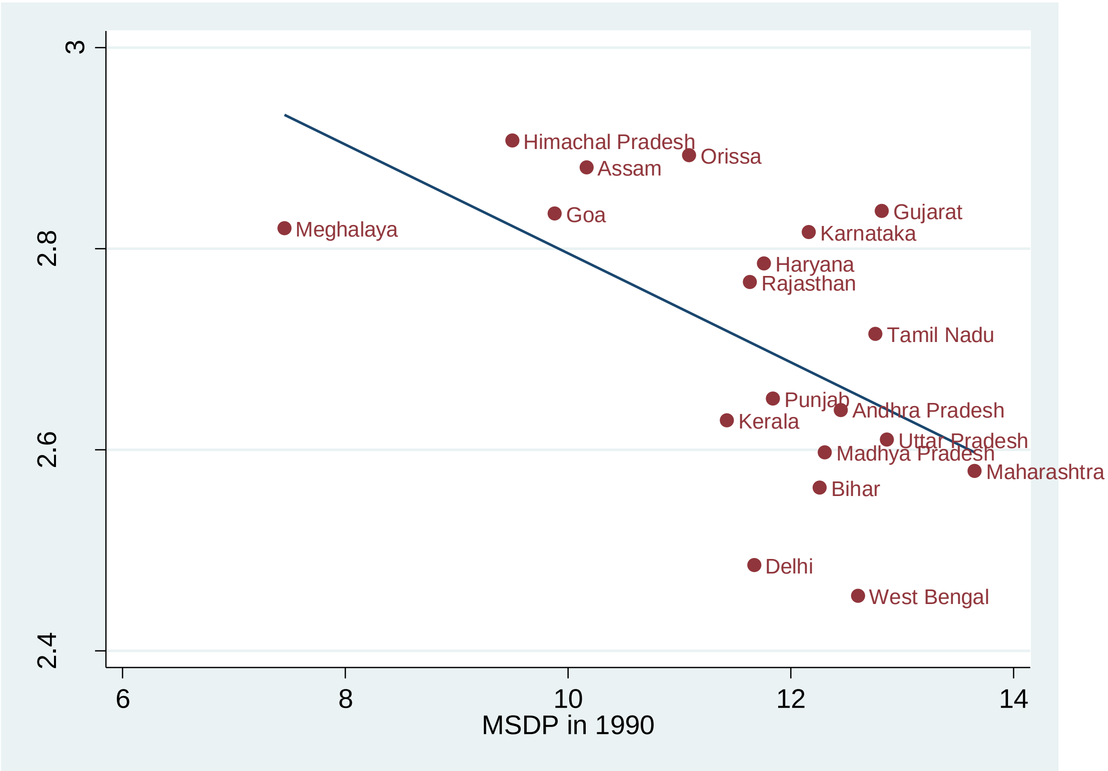
[37] If we disaggregate the manufacturing GSDP and look at the registered and the unregistered manufacturing performance separately, a similar pattern is observed. See Table A4.10 and Table A4.11 in the Appendix.

Figure 4.2: Testing the Convergence Hypothesis for 1980-2007



Source: Author's own calculations based on data from EPWRFITS.
Note: Both x and y variables are expressed in logs.

Figure 4.3: Testing the Convergence Hypothesis for 1990-2007



Source: Author's own calculations based on data from EPWRFITS.
Note: Both x and y variables are expressed in logs.

The graphs above plot the average growth rate of the states for the period 1980-07 and 1990-07 against the manufacturing GSDP in 1980 and 1990 respectively. If there is convergence with the income level of the richer states, the relationship should be downward sloping which is the case for Indian states. This evidence of convergence is contrary to the findings by some previous studies such as Chakravorty and Lall (2007). It may probably be due to the fact that those studies covered very few years after the 1991 reforms and did not include the 2000s when "laggard" states such as Bihar, Orissa and Meghalaya experienced a considerable increase in growth as compared to that in the 1990s.

In the next section, I present the empirical framework, discuss the reasons behind the choice of variables in my econometric model and explain in detail how I construct the proxies for trade openness of the Indian states.

4.2.4 Model and Variable Description

There are two surveys- Investment Climate Survey by World Bank and a survey of about 250 manufacturing firms by the Indian Council for Research on International Economic Relations (ICRIER)-which examined the views of the managers regarding factors they perceive as major obstacles for the operation of firms.[38] Around 40% of respondents cited infrastructure as a major obstacle.[39] The next on the list of problems were access to finance, skills and labour regulations. The ICRIER survey found that managers regard lack of infrastructure, skill and access to finance as the most serious obstacles for growth. We select the explanatory variables for our model of the basis of the findings of these two surveys. The model, in the general form, can be written as

[38] See Gupta et al. (2008) for a detailed discussion on these two surveys.
[39] Tax incentives also came out to be a major factor. However, as Gupta et al. (2008) say, it is not straight forward to interpret this finding as the firms will always prefer to pay as less as possible. So I ignore the tax-related issues in my analysis.

$\Delta Y_{it}=f(\grave{y}_{it}, enrol_{it}, manday_{it}, road_{it}/electricity_{it}, credit_{it}, TOI_{it})$

where at time t, in state i,

'Y'is the manufacturing GSDP growth rate in 1980-81 constant prices, 'ỳ'is the initial manufacturing GSDP, 'enrol' (proxy for human capital) is the enrolment ratio in middle schools, 'manday' (proxy for labour market regulations) is the number of man-days (in 1000s) lost per worker due to lockouts and strikes, 'road' (proxy for infrastructure) is the road density (in km per square km), 'electricity' (another proxy for infrastructure) is electricity generation in million kwh as a proportion of total persons engaged in registered manufacturing sector, 'credit' is industrial credit by scheduled commercial banks as percentage of manufacturing SDP and 'TOI' is the trade openness index. Data sources are given in the Appendix (Table A4.6).

To my knowledge, Marjit et al. (2007) is the only other paper which constructed an openness index of Indian states for the years 1980-2002. However, they had done it for 15 Indian states whereas my sample includes 22 states. The index introduced in this study also extends to more recent years.

Our analysis period ranges from 1988 till 2007. Years prior to 1988 could not be included in our study because tariff data is available from 1988 onwards. Years after 2007 could not be included because of unavailability of ASI data for the later years at the time this study was conducted. There can be endogeneity problem in our dataset because there can be reverse causality running from growth rate of manufacturing GSDP towards some independent variables such as the trade openness indices. Hence we work with 5 year averages of the data which will eliminate some of the endogeneity between SDP growth rate and trade openness variables. Moreover, our dependent variable is growth rate and it fluctuates greatly across years for all states. Hence, also to smoothen the data, we take 5 year averages.

I have worked at the 2-digit industry level following the NIC classification 1987. For the years from 1998 onwards, I have done a concordance between NIC 1987 and NIC 1998 in order to maintain consistency in the grouping of a product. Since, the focus of this paper is manufacturing output hence as per NIC 1987, I have included the divisions 20 to 38. The details of the divisions have been given in the Appendix (Table A4.9).

Construction of the Trade Openness indices

1) Export Openness Index: The first of the indices is known as Export Openness Index (EOI). The index aims to reflect extent of exports to other countries and not inter-state trade. Let us suppose that there are 2 states A and B in a country at time t which produces products, X and Y. The production share of A and B for producing X is 0.4 and 0.6 respectively. If the total export of X to other countries is 100 units then I assume that A exports 40 units out of it and B 60 units. Similarly, if the production share of A and B for producing Y is 0.3 and 0.7 respectively and the country exports 100 units of Y to other countries then, in that case, I assume that A exports 30 units of Y and B exports the remaining 70 units. Similarly, if the state would have produced more products, I would have calculated the potential export share using the production share.

Now if A's state domestic product is denoted as SDP and there are n products then the general expression for EOI for A will be as follows:-

$$EOI = (\sum_{p=1}^{n} exports) / SDP$$

where, p=product and EOI=export openness index.

Similarly, we calculate the export openness index for the other state, B. The higher the number, the more is the degree of openness of the state concerned. We expect the sign on the coefficient of this variable in the regression to be positive. As per the economic theories, a more open state should grow faster than a relatively less open state. In our data, the export openness index for a particular state in a particular period is the average of the export openness for that state over the entire 5 years period.

2) Industry Tariff Index: The other trade openness index is called Industry Tariff index (ITI). Let us assume that there are 2 states, A and B producing 2 products X and Y respectively. Let us suppose that the import tariff rate is higher for X than Y. We then argue that B should have a higher manufacturing SDP growth rate than A because the latter is engaged in import-substitution industrialisation. In other words, the state economy of A practises protectionism and hence will have comparatively inefficient industries because they are not exposed to foreign competition. On the other hand, B engages in a comparatively more export-oriented industrialisation (which makes its domestic industries more efficient through competition in world markets) and hence is expected to have a higher growth rate.

The index has been calculated as follows:-

Say there are 5 manufacturing product divisions-I, II, III, IV and V. The tariff rates (T) are 100,104,110,160,200 (in percentages) respectively. There are 2 states, A and B. Production share (PS) of A is 10,20,30,30 and 10 and that of B is 25,35,15,10 and 15 (in percentages) respectively. Then the Industry Tariff Index is calculated, for state i at time t, as

$ITI_{it}=\Sigma(T_{it}*PS_{it})$

The lower the magnitude of the index the more open the state is. We expect the index to have a negative coefficient because protectionism or import-substitution strategy hampers growth. Table 4.14 below presents the trade openness index for each state in our sample. Column III and IV present the openness index based upon the level of trade barrier and trade volume respectively. The 20 year time period considered for our econometric analysis has been divided into four 5-year time periods and, accordingly, the openness indices are also based on 5 year averages for each of those four periods. For example, export openness index for Andhra Pradesh is 0.147 during the time period 2003-07. This implies that the average export openness of Andhra Pradesh during this 5-year time period is 14.7%.

It is worth acknowledging in this context that these indices are not entirely flawless. Essentially, these indices reflect the trade intensity of products produced in different states. One may argue that the estimated 'openness' in the study is likely to be outcome of growth rather than driver of growth which can be true to some extent. That is because trade policy is formulated at the country level in India and the individual states do not have the authority to design independent trade deals with foreign firms. So, the difference that we see in the openness at the state level may be driven by other policy measures affecting labour market conditions and investment climate which differ between individual states. However, this is the best that could be done in order to carry out the analysis because of lack of trade data at the state level.

Table 4.14: Trade Openness Indices for Indian states

State	Year	Industry Tariff Index (ITI)	Export Openness Index (EOI)
Andhra Pradesh	1988-92	151.8	0.037
Andhra Pradesh	1993-97	65.6	0.056
Andhra Pradesh	1998-02	33.74	0.07
Andhra Pradesh	2003-07	21.45	0.147
Assam	1988-92	142.8	0.092
Assam	1993-97	60.83	0.106
Assam	1998-02	31.66	0.086
Assam	2003-07	19.91	0.231
Bihar	1988-92	121.5	0.126
Bihar	1993-97	51.65	0.049
Bihar	1998-02	33.38	0.058
Bihar	2003-07	20.55	0.110
Gujarat	1988-92	128.28	0.022
Gujarat	1993-97	53.2	0.056
Gujarat	1998-02	31.96	0.108
Gujarat	2003-07	18.8	0.194
Haryana	1988-92	123.49	0.023
Haryana	1993-97	52.98	0.072
Haryana	1998-02	33.85	0.116
Haryana	2003-07	24.86	0.208
Karnataka	1988-92	136.76	0.03
Karnataka	1993-97	57.84	0.071
Karnataka	1998-02	33.73	0.119
Karnataka	2003-07	22.03	0.179
Kerala	1988-92	145.4	0.033
Kerala	1993-97	62.18	0.053

Kerala	1998-02	32.3	0.088
Kerala	2003-07	21.45	0.132
Madhya Pradesh	1988-92	132.51	0.028
Madhya Pradesh	1993-97	53.04	0.048
Madhya Pradesh	1998-02	34	0.064
Madhya Pradesh	2003-07	20.81	0.117
Maharashtra	1988-92	126.4	0.024
Maharashtra	1993-97	53.69	0.067
Maharashtra	1998-02	32.23	0.146
Maharashtra	2003-07	20.33	0.272
Orissa	1988-92	127.55	0.049
Orissa	1993-97	51.12	0.062
Orissa	1998-02	33.72	0.103
Orissa	2003-07	19.12	0.182
Punjab	1988-92	130.44	0.032
Punjab	1993-97	55.51	0.082
Punjab	1998-02	34.38	0.109
Punjab	2003-07	25.92	0.164
Rajasthan	1988-92	128.78	0.031
Rajasthan	1993-97	55.44	0.063
Rajasthan	1998-02	33.84	0.104
Rajasthan	2003-07	20.95	0.172
Tamil Nadu	1988-92	129.39	0.037
Tamil Nadu	1993-97	56.37	0.079
Tamil Nadu	1998-02	33.92	0.127
Tamil Nadu	2003-07	22.58	0.224
Uttar Pradesh	1988-92	135.1	0.032
Uttar Pradesh	1993-97	57.75	0.06
Uttar Pradesh	1998-02	33.74	0.109
Uttar Pradesh	2003-07	22.64	0.173

West Bengal	1988-92	126.53	0.035
West Bengal	1993-97	53.97	0.055
West Bengal	1998-02	32.61	0.053
West Bengal	2003-07	20.17	0.089
Delhi	1988-92	143.62	0.064
Delhi	1993-97	60.34	0.11
Delhi	1998-02	33.72	0.165
Delhi	2003-07	21.5	0.135
Goa	1988-92	131.3	0.043
Goa	1993-97	61.06	0.072
Goa	1998-02	33.43	0.118
Goa	2003-07	20.59	0.361
Himachal Pradesh	1988-92	138.85	0.062
Himachal Pradesh	1993-97	58.62	0.092
Himachal Pradesh	1998-02	33.69	0.132
Himachal Pradesh	2003-07	18.79	0.507
Meghalaya	1988-92	200	0.192
Meghalaya	1993-97	65.11	0.036
Meghalaya	1998-02	33.49	0.012
Meghalaya	2003-07	18.08	0.119
Correlation Coefficient between the two indices= -0.47 (p-value=0.00)			

Source: Author’s own calculations.

According to 2003-07 figures, Himachal Pradesh is the most open state in terms of exports volume (50.7%) followed by Goa (36.1%); whereas West Bengal is the least open state (8.9%). Among the larger states, Maharashtra is the most open of all (27.2%). In terms of tariff openness index, Meghalaya is the most open state (tariff index=18.08) with Himachal Pradesh being marginally behind (18.79). As expected, there is a statistically significant negative correlation (-0.47) between the two indices. We compare the relative state rankings in terms of export openness index between the starting and the end periods in Table 4.15 below.

Table 4.15: Export Openness Index, 1988-92 and 2003-07

State	Export Openness Index_2003-07	Rank	Export Openness Index_1988-92	Rank
Himachal Pradesh	0.507	1	0.062	5
Goa	0.361	2	0.043	7
Maharashtra	0.272	3	0.024	17
Assam	0.231	4	0.092	3
Tamil Nadu	0.224	5	0.037	8
Haryana	0.208	6	0.023	18
Gujarat	0.194	7	0.022	19
Orissa	0.182	8	0.049	6
Karnataka	0.179	9	0.03	15
Uttar Pradesh	0.173	10	0.032	12
Rajasthan	0.172	11	0.031	14
Punjab	0.164	12	0.032	12
Andhra Pradesh	0.147	13	0.037	8
Delhi	0.135	14	0.064	4
Kerala	0.132	15	0.033	11
Meghalaya	0.119	16	0.192	1
Madhya Pradesh	0.117	17	0.028	16
Bihar	0.11	18	0.126	2
West Bengal	0.089	19	0.035	10

Source: Author’s own calculations. Export Openness Index_2003-07 and Export Openness Index_1988-92 stand for openness index during the time period 2003-07 and 1988-02 respectively.

It can be seen that the rankings have changed considerably over time for many states. The starting point of our sample period, 1988-92, denotes that time when India has just started to adopt widespread trade reforms. The states which improve their ranks drastically over this span of 20 years are all the high performers like Maharashtra, Haryana and Gujarat. For instance, Maharashtra, which was ranked 17th out of the 19 states during 1988-92, came up to the 3rd position during 2003-07. Similarly, Haryana and Gujarat were placed at the last two ranks during the start of the sample period. However, they ended up at the 6th and 7th

positions respectively. On the other hand, states such as West Bengal, Kerala and Meghalaya experienced significant deterioration in their ranks. In Tables 4.16 and 4.17, we rank the states according to the two openness indices during 2003-07 and the corresponding average manufacturing GSDP growth rate during 2000-09. Column III in both the tables ranks the states according to the corresponding degree of trade openness. Ranks presented in columns V, VII and IX denote ranks assigned to a state on the basis of aggregate, registered and unregistered manufacturing sectors average GSDP growth rates during 2000-09 respectively.

Table 4.16: Ranking the states by Export Openness Index and Manufacturing Performance

State	Export Openness Index	Rank	Manufacturing GSDP growth rate(%)	Rank	Registered sector growth rate(%)	Rank	Unregistered sector growth rate(%)	Rank
Top 10 states in terms of trade openness								
Himachal Pradesh	0.507	1	6.05	11	6.93	13	7.21	5
Goa	0.361	2	4.18	17	2.33	18	6.82	6
Maharashtra	0.272	3	6.99	7	12.64	3	7.75	4
Assam	0.231	4	6.86	8	2.86	17	6.31	10
Tamil Nadu	0.224	5	5.28	14	7.4	11	3.47	18
Haryana	0.208	6	7.69	5	8.18	8	6.66	8
Gujarat	0.194	7	9.41	4	10.77	5	8.23	1
Orissa	0.182	8	14.36	2	18.95	2	6.76	7
Karnataka	0.179	9	10.94	3	11.45	4	5.26	14
Uttar Pradesh	0.173	10	6.03	12	9.54	6	6.54	9
Remaining States								
Rajasthan	0.172	11	5.41	13	7.47	10	7.79	3
Punjab	0.164	12	5.15	15	7.39	12	4.65	17
Andhra Pradesh	0.147	13	6.37	10	8.5	7	5.11	16
Delhi	0.135	14	7.17	6	4.64	15	8.2	2
Kerala	0.132	15	4.6	16	5.98	14	5.57	13
Meghalaya	0.119	16	17.31	1	36.18	1	5.2	15
Madhya Pradesh	0.117	17	1.2	19	7.74	9	2.83	19
Bihar	0.11	18	6.67	9	2.25	19	5.87	12
West Bengal	0.089	19	3.97	18	4.32	16	6.2	11

Source: Author’s own calculations.

Maharashtra, Gujarat, Haryana and Orissa seem to be the most consistent performers. These states register some of the highest growth rates in both the registered and unregistered manufacturing sectors. Regardless of which trade openness index is considered, Maharashtra, Orissa, Gujarat, Himachal Pradesh and Assam are also amongst the most open states in India. Conversely, states such as Punjab, West Bengal and Kerala are some of the least open states and also the worst performers, as far as manufacturing is concerned.

Table 4.17: Ranking the states by Industry Tariff Index and Manufacturing Performance

State	Industry Tariff Index	Rank	Manufacturing GSDP growth rate(%)	Rank	Registered sector growth rate(%)	Rank	Unregistered sector growth rate(%)	Rank
Top 10 states in terms of trade openness								
Meghalaya	18.08	1	17.31	1	36.18	1	5.2	15
Himachal Pradesh	18.79	2	6.05	11	6.93	13	7.21	5
Gujarat	18.8	3	9.41	4	10.77	5	8.23	1
Orissa	19.12	4	14.36	2	18.95	2	6.76	7
Assam	19.91	5	6.86	8	2.86	17	6.31	10
West Bengal	20.17	6	3.97	18	4.32	16	6.2	11
Maharashtra	20.33	7	6.99	7	12.64	3	7.75	4
Delhi	21.5	8	7.17	6	4.64	15	8.2	2
Bihar	20.55	9	6.67	9	2.25	19	5.87	12
Goa	20.59	10	4.18	17	2.33	18	6.82	6
Remaining States								
Madhya Pradesh	20.81	11	1.2	19	7.74	9	2.83	19
Rajasthan	20.95	12	5.41	13	7.47	10	7.79	3
Andhra Pradesh	21.45	13	6.37	10	8.5	7	5.11	16
Kerala	21.45	14	4.6	16	5.98	14	5.57	13
Karnataka	22.03	15	10.94	3	11.45	4	5.26	14
Tamil Nadu	22.58	16	5.28	14	7.4	11	3.47	18
Uttar Pradesh	22.64	17	6.03	12	9.54	6	6.54	9
Haryana	24.86	18	7.69	5	8.18	8	6.66	8
Punjab	25.92	19	5.15	15	7.39	12	4.65	17

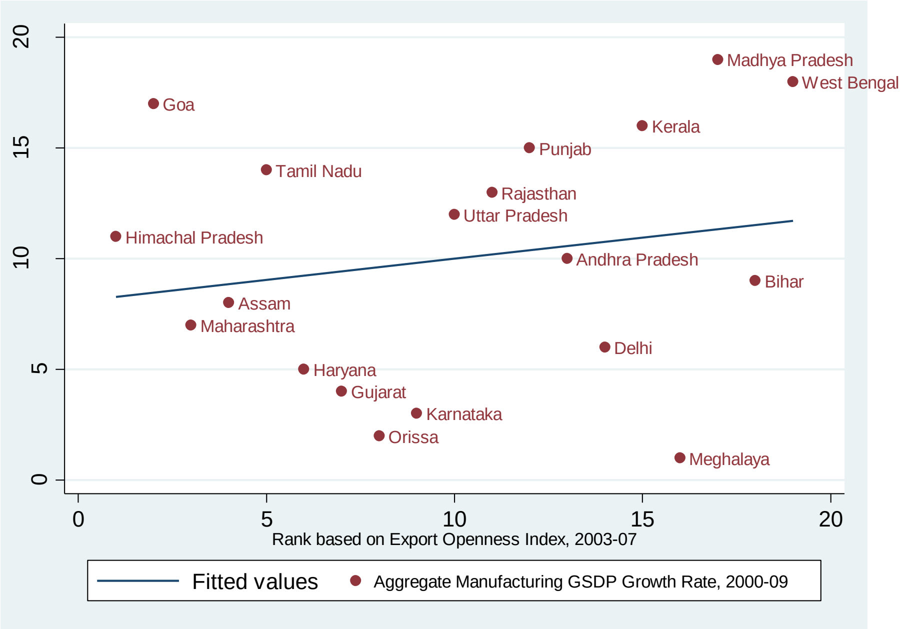
Source:- Authors' own calculations.

Haryana and West Bengal achieve quite dissimilar ranks across the two measures. For instance, West Bengal is the least open state when trade volumes are considered; whereas it ranks at the 6th position among the 19 states if trade openness is measured using industry tariffs.

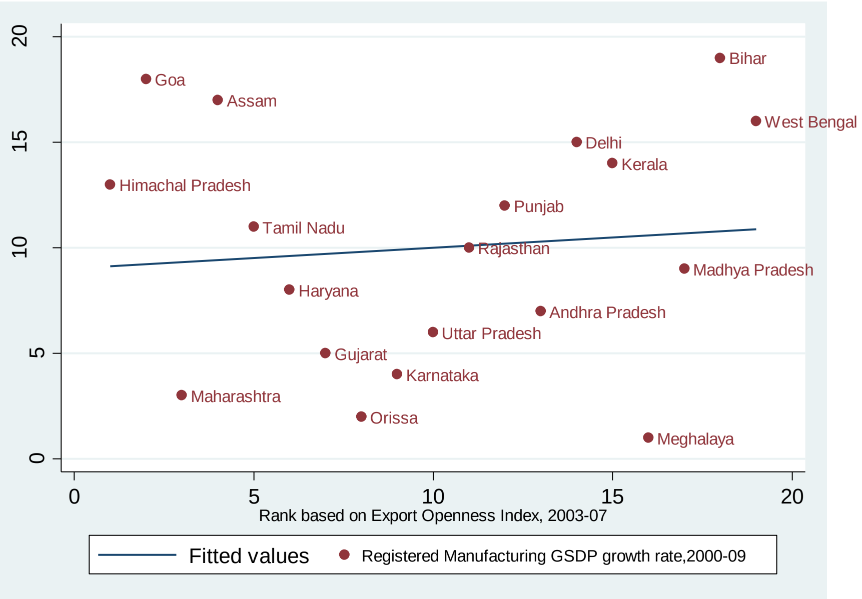
Another picture which emerges is that of a mixed performance in the two sub-sectors by a few states. For example, in terms of average growth rates, Meghalaya has experienced the fastest growth in registered manufacturing during the last decade but when it comes to the unregistered sector, it is one of the most unimpressive performers. Similar performance is displayed by Karnataka too. Exactly an opposite picture is projected by Himachal Pradesh and Delhi. For instance, Himachal Pradesh has one of the fastest growing unregistered manufacturing sector in India (ranked 5th) but not so when the registered sector is considered (13th).

A scatterplot analysis reveals that there may exist some correlation between trade openness and manufacturing performance though the degree of correlation seems to differ significantly across the two different manufacturing sub-sectors. Figures 4.4 (a-c) present the scatter diagram with ranks of the states on the basis of export openness index during 2003-07 as the x-variable and that on basis of aggregate, registered and unregistered manufacturing average growth rate during 2000-09 as the y-variables respectively. In other words, we examine whether a higher degree (or, rank) of trade openness enables the states to achieve a higher rank in terms of manufacturing growth rate in the following scatter diagrams.

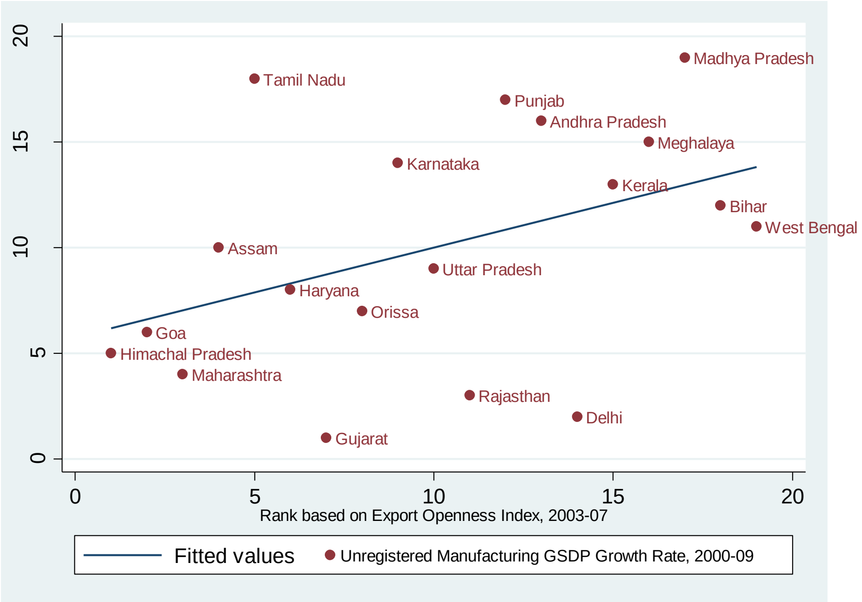
Figure 4.4: Export Openness Index and Manufacturing Growth Scatterplot



(a)



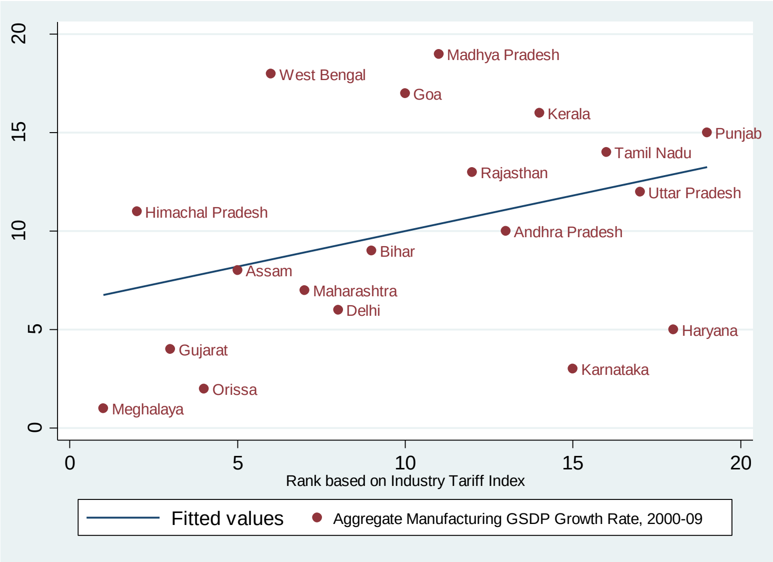
(b)



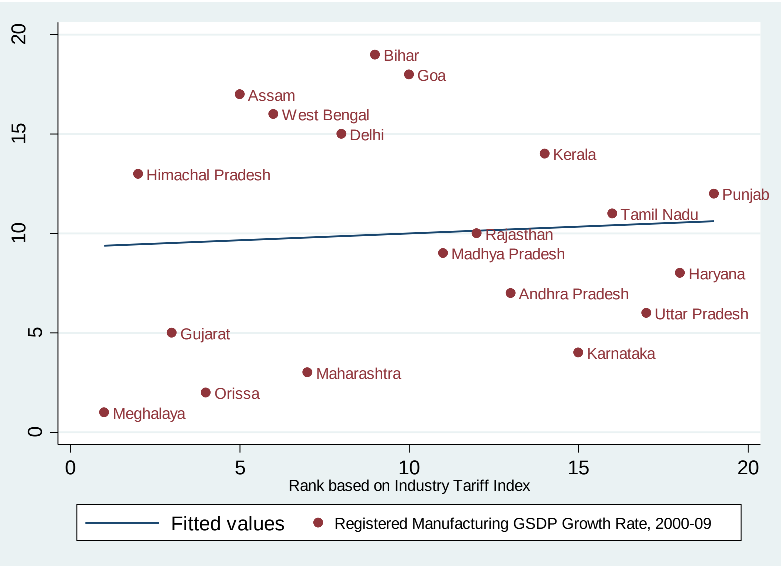
(c)

The unregistered manufacturing sector seems to have some correlation with trade openness (Figure 4.4c). In line with the theoretical expectations, the slope of the line of best fit is positive indicating that a higher level of trade openness is associated with higher growth rate in the unregistered sector. However, this positive relationship seems to be non-existent if we look at the registered sector (Figure 4.4b). At an aggregate level, there is some positive correlation present though it does not seem to be very strong. We examine the correlation between manufacturing growth and industry tariff index in the Figures 4.5(a-c). Overall, the picture obtained is very similar to that of the previous scatterplot. The unregistered sector exhibits a strong correlation with trade openness; whereas there seems to be no relationship between registered sector and the tariff index. It looks like that the positive relationship between aggregate manufacturing sector and trade openness is solely driven by the unregistered sector. As seen in the figures below, the slope of the line of best fit is positive since the ranks were assigned in such a way that the least protected state achieves the rank of 1 and the most protected achieves the last-the 19th rank.

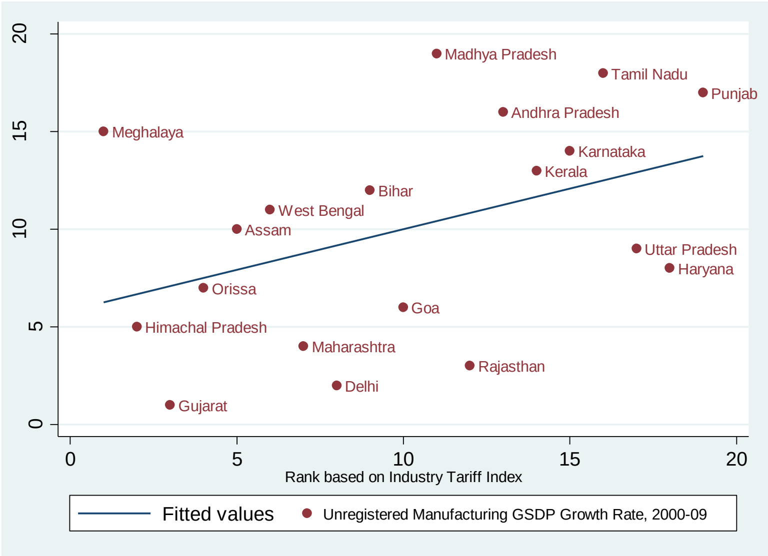
Figure 4.5: Industry Tariff Index and Manufacturing Growth Scatterplot



(a)



(b)



(c)

In the following section, we re-examine the empirical relationship between manufacturing growth and trade openness using panel data analysis. The estimating panel regression equation (with ‘road’ and ‘EOI’ as proxies for infrastructure and trade openness respectively) can be written as:-

$$\Delta Y_{it} = \beta_0+\beta_1 L\grave{y}_{it}+\beta_2 Lenrol_{it}+\beta_3 mandays_{it}+\beta_4 Lcredit_{it}+\beta_5 Lroad_{it}+\beta_6 LEOI_{it}+e_{it} \quad (2)$$ [40]

Similarly, equation with electricity and ITI as alternate proxies for infrastructure and trade openness will be specified. All the variables are expressed in their natural logarithms apart from the dependent variable and ‘mandays’. The former could not be taken in logs because there are many negative values in our dataset. For example, Orissa, Kerala and Madhya Pradesh had negative manufacturing growth rates during the period 1998-2002. Hence we take the variable in levels in order to avoid loss of observations. The variable, ‘mandays’, has been taken in levels because for many states it takes the value 0. Since ‘road’ and ‘electricity’ are both proxies for infrastructure so they enter the equations separately. Similarly, the trade openness indices enter the equation one at a time. As mentioned previously, we separately re-estimate the model for registered and unregistered manufacturing sectors as well.

[40]where, ‘L’ stands for logarithm. For instance, ‘LEOI’ means log of Export Openness Index.

4.2.5 Results and Discussion

I initially estimated my model using Fixed Effects (FEM) Modelling technique. However, the problem of autocorrelation was detected and so I re-estimated using Feasible Generalized Least Squares (FGLS) method. FGLS method allows estimation in the presence of first-order autocorrelation within panels, heteroskedasticity or cross-sectional correlation across panels.[41]

The results from the FEM model with aggregate manufacturing GSDP has been presented in Table 4.18. Models 1 and 2 both estimate a gross relationship between manufacturing GSDP and Industry Tariff Index (ITI) and manufacturing GSDP and Export Openness Index (EOI) respectively. Models 3 and 4 both estimate the fully-specified model with road density as the proxy for infrastructure. Models 5 and 6 re-assess the full model with electricity as the proxy for infrastructure. There is strong evidence that trade openness affects manufacturing GSDP growth positively with the coefficients on 'LITI' being negative and significant in Models 1 and 5 and that on 'LEOI' being positive and significant in Models 2, 4 and 6. The effect of trade volume (LEOI) seems to be slightly more robust than trade barriers because the coefficient on the former retains statistical significance irrespective of which model specification I use. One percentage point increase in export openness index leads to an increase of approximately 50 units in Manufacturing SDP. Apart from the trade variables, 'Lenrol', which is a proxy for human capital, appears to have a positive and (almost always) significant coefficient. Access to industrial credit also seems to be important in determining the growth rate of the manufacturing sector. Initial SDP has always come out with a negative and significant coefficient which provides further support for the Convergence Hypothesis.

[41] For a detailed discussion on the FGLS estimation procedure, see Beck and Katz (1995).

Table 4.18: Fixed Effects Model Estimation Results

Independent variables	**Coefficients (FE model) Model 1**	**Coefficients (FE model) Model 2**	**Coefficients (FE model) Model 3**	**Coefficients (FE model) Model 4**	**Coefficients (FE model) Model 5**	**Coefficients (FE model) Model 6**
Lẏ	-7.5***	-3.26*	-9.07***	-8.9***	-6.73***	-7.5***
Lelectricity					2.83	2.6
mandays			-37.03	-59.47	-38.5	-89.07
Lenrol			7.44*	5.6*	6.86*	5.48
Lroad			-3.66	-1.2		
Lcredit			3.24	4.51**	2.5	3.68***
LITI	-4.65***		-3.06		-2.18*	
LEOI		2.8***		1.95**		2.08*
constant	114.05***	52.3**	131.8**	116.98*	85.7***	100.9**
Wooldridge test for autocorrelation H_0:No Autocorrelation			P-value=0.95	P-value=0.47	P-value=0.79	P-value=0.29

Note: Dependent variable= Growth rate of Aggregate Manufacturing SDP. Errors used are heteroskedasticity-robust standard errors. ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.

Next we estimate the models with registered and unregistered manufacturing as the dependent variables. The results that are presented below in Tables 4.19 and 4.20suggest that trade openness has absolutely no impact on registered manufacturing growth rate across states.

Table 4.19: Fixed Effects Model Results for Registered Manufacturing

Independent variables	**Coefficients (FE model)** **Model 1**	**Coefficients (FE model)** **Model 2**	**Coefficients (FE model)** **Model 3**	**Coefficients (FE model)** **Model 4**
Lẏ	-5.96	-6.51	-0.78	-2.03
mandays			-204.3*	-113.07
Lenrol			10.85	12.7
Lroad			4.29	6.98
Lcredit			7.9**	6.24***
LITI	-0.22		-3.49	
LEOI		-0.09		-0.4
constant	-60.5	-67.8	112.4	108.57
Wooldridge test for autocorrelation H_0:No Autocorrelation			P-value=0.01	P-value=0.04

Note: Results do not change even when we include electricity as the proxy for infrastructure instead of road density. Hence, we do not report the results.

As can be seen from the table above, there is problem of autocorrelation in our model with registered manufacturing as the dependent variable. So we do not conclude anything from the results and instead re-estimate the model using FGLS method (Table 4.20). The results do not change apart from only that now initial SDP has turned significant statistically. We see some evidence that states with better financial markets experience a faster growth in the registered manufacturing sector.

Table 4.20: FGLS regression results

Independent variables	**Coefficients (FE model)** **Model 3**	**Coefficients (FE model)** **Model 4**
Lẏ	-0.87*	-0.78*
mandays	-182.96	-193.2
Lenrol	6.27*	6.09*
Lroad	3.14	3.24
Lcredit	3.1*	3.89**
LITI	-0.84	
LEOI		-0.33
constant	26.7	26.1

Note: Results do not change even when I include electricity as the proxy for infrastructure instead of road density. Hence, I do not report the results here.

Table 4.21 presents the estimation results with unregistered manufacturing SDP growth rate as the dependent variable. Models 1 and 2 estimates the gross relationship with tariff and export share as the trade openness variables respectively. 3 and 4 are the fully-specified models with road as the proxy for infrastructure. We get very similar results when we replace road with electricity. That is why we do not separately report the estimation results from those equations which have electricity as the proxy for infrastructure. Also we drop the 'mandays' variable because normal labour laws do not apply in the informal sector.

Table 4.21: Fixed Effects Model Results for Unregistered Manufacturing

Independent variables	**Coefficients (FE model)** **Model 1**	**Coefficients (FE model)** **Model 2**	**Coefficients (FE model)** **Model 3**	**Coefficients (FE model)** **Model 4**
Lẏ	-9.39***	-6.64***	-9.32***	-9.44***
Lenrol			0.96	-0.47
Lroad			0.15	2.04
Lcredit			1.41	2.42*
LITI	-4.32***		-3.2*	
LEOI		3.46***		2.74**
constant	124.01**	86.3**	120.86**	111.09**
Wooldridge test for autocorrelation H_0:No Autocorrelation			P-value=0.63	P-value=0.98

The econometric results obtained from estimation of the full model (Models 3 and 4) indicate that 1% increase in export openness will lead to an increase of around 36 units in unregistered manufacturing GSDP. With a similar increase in trade barriers, we would expect a decline of around 31 units in GSDP. Apart from the trade variables and initial GDP, ‘credit’ also seems to be an influential determinant of manufacturing performance in the unregistered sector; 1% increase in industrial credit leads to around 41 units increase in unregistered manufacturing GSDP.

The finding that trade openness has a positive and statistically significant impact on the growth rate of unregistered manufacturing but no impact on that of registered manufacturing is a very interesting result which partially contradicts the findings of most past studies on Indian manufacturing performance, both at the country and state level. In other words, contrary to the view that manufacturing sector failed to take advantage of trade openness, my results indicate that it is only the unregistered sector which bears a significant and positive relationship with trade openness. The reasons behind such outcome are probably the following:

i) **Lack of stringent labour laws:** Firstly, the unregistered manufacturing units operate under a more liberal environment. In other words, there is more flexibility in day-to-day operations of a firm in unregistered sector. Flexibility in factor markets is required to take advantage from trade liberalisation. This is because opening up to trade leads to restructuring across the economic sectors. As an economy opens up, sectors where the economy has comparative advantage expand. Conversely, import-substituting sectors shrink because openness brings in foreign competition which compels the previously protected and inefficient firms to close down. Consequently, unemployment rises in the sectors which were previously import-substituting and workers start to move into the expanding sectors where there is comparative advantage. However, the registered sector in India cannot undergo this restructuring encouraged by comparative advantage due to rigid labour laws (particularly, the Industrial Disputes Act[42]) and other policy-induced impediments and that is why the impact of the trade reforms is probably not showing up.

ii) **Exit of inefficient small firms:** Nataraj (2011) estimated the impact of India's trade liberalisation on the productivity of both registered and unregistered manufacturing firms and made an observation similar to my findings. The paper found that the negative relationship between final goods tariffs and productivity is driven by the unregistered sector. Once input

[42] The Industrial Disputes Act (1948) requires firms employing more than 100 workers to obtain authorisation from the government for retrenchment, layoff and closure of any production unit.

tariffs are controlled for, the relationship between final goods tariffs and registered sector productivity is statistically insignificant. The study has argued that the main driver behind increased average productivity is the exit of the least productive small firms. Since these firms are found predominantly in the informal sector hence such exit increases the unregistered sector productivity (and, eventually, the sector's growth rate) leaving the registered sector productivity largely unchanged.

iii) **Sub-contracting from registered to unregistered sector:** Outsourcing or sub-contracting of work from registered to unregistered sector is another consequence of trade liberalisation. When faced with competition from cheap foreign imports after trade reforms were undertaken, registered firms were compelled to cut down their costs. Hence, they started to outsource some part of the production to unregistered firms where the wages are much lower and the firms also do not have to spend on worker benefits and social security (Goldar and Aggarwal, 2012). The share of contract workers in total employment in the registered manufacturing sector increased from 15.7% in 2000-2001 to 26.47% in 2010-2011. Consequently, the share of directly employed workers fell from 61.12% to 51.53% in the same period (Kapoor, 2014). [43]Using econometric analysis, Goldar and Aggarwal (2012) show that import competition in the post-reform era has been responsible, to some extent, for the greater informalisation of industrial labour. Kathuria et al. (2013) also regard the increase in sub-contracting as an indirect effect of trade reforms as registered firms entered into sub-contracting arrangements with unregistered firms for supply of inputs, and invested in the technological capabilities of unregistered firms so as to obtain reliable and high quality specialised intermediate and capital goods.

[43] Rigid labour laws are also to be blamed for the rise in the use of contract workers in the formal sector. See Sen et al. (2010) for a detailed discussion.

On the other hand, apart from the aforementioned factors, the reasons why we do not observe any significant relationship between the registered sector performance and trade openness are the following:

a) **Industrial reforms of the 1980s:** It is the reforms of the 1980s (or, the industrial reforms) which mattered more significantly for the registered manufacturing sector as compared to trade reforms (Rodrik and Subramanian, 2004). All the "pro-business" reforms such as removal of price controls, access to foreign intermediate goods, gradual abolition of the 'license-raj'[44], capacity expansion for incumbents and reduction in corporate taxes took place in the 1980s. In other words, the "attitudinal" shift in the government's policy-making with regards to business and privatisation took place in the 1980s. The reforms undertaken since 1991 such as trade reforms were more 'pro-market' rather than 'pro-business'. However, it must be asserted in this context that all the 'pro-market' reforms of the 1990s were also undertaken to boost the overall manufacturing sector (especially, the registered segment).

b) **Lag effects of Trade Reforms:** Hypothetically speaking, economic reforms are expected to improve the growth performance of the manufacturing sector because of static efficiency gains through reallocation of factors as well as dynamic efficiency gains through trade liberalisation. The puzzle of India's reforms is that a surge in productivity growth was observed following the 1980s reforms, but no such pattern or probably even an inverse pattern was observed immediately after the 1990s reforms when the productivity growth decelerated from growth rates observed in the 1980s (Goldar and Kumari, 2003 and Virmani and Hashim, 2011).

[44] **License Raj:** After independence, India's industrial policy had been shaped by the 1951 Industries (Development and Regulation) Act which introduced an elaborate system of licenses and permits that regulated and restricted entry of new firms and expansion of existing ones (Aghion, et al., 2008).

Some studies have put forward the 'J curve of liberalisation and productivity'[45]hypothesis and have argued that the effects of the trade reforms of the 1990s may have started to be felt in Indian manufacturing with a time lag. While the 1980s reforms involved limited deregulations and partial liberalisation of a few aspects of the existing control regime, the 1990s reforms were 'wider and deeper' in nature (Sachs et al., 2000).During the 1990s, when the Indian economy underwent a structural transformation from a closed structure to an increasingly globalised one, the transition has probably led to a slowdown in productivity growth. As Virmani and Hashim (2011) put it, such slowdown would occur both in sectors and sub-sectors far from the global technology frontier (for example, obsolescence of product lines and skills) and in the aggregate in the initial stages of transition (for instance, diversion of human resource for learning new technology and markets). Once the firms adjust to the initial shock of opening up, they start experiencing the rise in productivity and output growth. Using data from 1981 till 2007, the 2011 Virmani and Hashim study examines productivity growth in Indian registered manufacturing industries and concludes that there is evidence of a J curve pattern in manufacturing output growth as a result of the 1990s reforms. Of the 22 sub-sectors of manufacturing for which the study estimated total factor productivity growth, 3 followed an S-curve pattern (14%), 8 followed a J curve pattern (36%) and 10 followed a hybrid S-J pattern (45%). Hashim et al. (2009) also find support for the J curve hypothesis and concluded that the 1990s reforms have started showing the expected positive effects on productivity and output growth in later years. Both Hashim et al. (2009) and Virmani and Hashim (2011) found a much higher growth rate in TFP in registered manufacturing in the period 2002-2003 to 2007-2008 as compared to the periods 1992-1993 to 1997-1998 and 1998-1999 to 2001-2002.

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[45]**The J curve hypothesis of import liberalisation and productivity change**: In a heavily protected economy, a major import liberalisation will initially slow down measured productivity growth and result in its acceleration only after a lag (Virmani, 2005).

4.2.6 Conclusion and Policy Implications

The study investigates the determinants of manufacturing GSDP growth of 22 Indian states for the time period 1988-2007. Overall, it can be asserted that there is a robust association between trade openness and manufacturing sector performance in Indian states. Trade openness seems to have a positive impact on aggregate manufacturing growth. In line with the conventional view, trade barriers have a negative impact on manufacturing growth whereas trade volumes have a positive impact. This trade-manufacturing growth link does not show up when we estimate the relationship using country level data. That is probably because the heterogeneous performance of different states drives the overall relationship insignificant. In other words, some states, such as Orissa, clearly took advantage of the post-1991 trade reforms and achieved faster growth whereas others such as West Bengal failed to do so. The aggregate level analysis could not capture this heterogeneity in the state performance.

One of the most interesting findings is that trade openness does not affect the performance of the registered manufacturing sector at all but has a strong positive impact on the growth of the unregistered sector. The reasons why registered sector failed to take advantage of trade reforms are as follows. Firstly, prevalence of rigid labour laws in India seems to be a major factor. That is because, as an economy opens up, the sectors in which it has a comparative advantage expands and where it does not (maybe previously import-substituting sectors), shrinks. As a result, unemployment in the firms in the latter sectors rises and a restructuring takes place in the economy with workers moving into those sectors where the comparative advantage lies. However, this restructuring is maybe hindered in the registered manufacturing sector of India due to stringent labour regulations. As a result, we do not see any impact of trade openness on the performance of this sector. Secondly, some researchers argue that it is the 1980s industrial reforms which benefitted the manufacturing sector and not the 1990s trade reforms because the latter were more ‘pro-market’ rather than ‘pro-business’. Having operated in an environment which provided the Indian firms protection from any kind of foreign competition for nearly four decades, the Indian firms were initially unable to cope with the competition of cheap imports from abroad. Hence, the positive effects of post-1991 trade reforms were probably felt with a significant time lag.

The reasons why the unregistered sector, on the other hand, benefitted from trade openness can be broadly grouped into the following categories. Firstly, the unregistered sector is exempted from the labour regulations and hence could undergo the necessary restructuring as per its comparative advantage after the economy opened up. Moreover, the inefficient firms in this sector probably could close down (because the Industrial Disputes Act does not apply here) which further enhanced the productivity and, eventually, accelerated the growth rate of the entire sector. Secondly, the sector also benefitted from the increase in subcontracting activities from the registered firms.

Apart from the trade variables, human capital and access to industrial credit seem be important determinants of manufacturing growth. However, the impact is not very robust. Contrary to many past studies, we have found some evidence of convergence among Indian states in terms of growth rate in the manufacturing sector.

Comparing the Indian experience with other countries: In light of the findings of Chapter 3 and 4, it can be said that India's experience with trade openness has been quite similar to that of several other countries. For instance, Chen and Feng (2000) examine the determinants of economic growth of China using provincial data and conclude that international trade plays a significant role. Sikwila et al. (2014) test the relationship between trade openness and economic growth of South Africa using time series approach. The paper finds that trade openness has impacted growth in South Africa both in the short and long run. Darrat et al. (2002) conclude that trade openness has been a significant catalyst of growth in Taiwan.

Economidou and Murshid (2007) observe that a higher exposure to trade (particularly, imports) lead to higher factor productivity and, thus, eventually faster economic growth in 12 OECD countries during the time period 1978-1997. Olufemi (2004) examine the effects of trade openness on the Nigerian economy and concludes that there is a unidirectional causality from trade towards growth. Furthermore, the paper finds that the relationship depends on the level of economic development of Nigeria. Duc (2008) finds that trade had a negative effect on Thailand's per capita income prior to 1980 when the country followed the policy of import substitution. Trade started to exert a positive impact on growth with the emergence of manufactured exports since 1980 onwards.

Policy Implications: Compared to the other rapidly developing countries such as China, foreign direct investment in registered manufacturing sector is really low in India. Rigid labour regulations impose a cost on the entrepreneurs and that is undoubtedly part of the reason why they are reluctant in investing in the registered sector. India is endowed with a vast and excess labour force waiting to be mobilised into manufacturing from agriculture. This mobilisation is only possible if the states carry out reforms in their labour regulations along with other necessary fiscal and administrative reforms. That will help them take advantage of the macro-level economic reforms and expand their industrial base.

Appendix 4

Table A4.1: Data source for Chapter 4.1

Variable	**Variable Source**
Agricultural GDP at factor cost, Manufacturing GDP at factor cost, Services GDP at factor cost, Aggregate GDP/capita	Handbook of Statistics on Indian Economy 2011-12, Reserve Bank of India (RBI).
Agricultural Trade (% of aggregate GDP), Agricultural raw material imports (% of merchandise imports), Manufacturing trade(% of GDP), Services trade (% of GDP)	World Development Indicators (WDI, 2011/12), World Bank
Direct Institutional (both short and long term) credit to agriculture, Industrial credit	Handbook of Statistics on Indian Economy 2011-12, Reserve Bank of India (RBI)
Irrigated land(% of total agricultural area)	World Development Indicators (WDI), World Bank
Gross capital formation in agriculture,	Agricultural statistics at a glance 2012, Ministry of Agriculture, Government of India
Fertilizers	Agricultural statistics at a glance 2012, Ministry of Agriculture, Government of India
Terms of trade	Agricultural statistics at a glance 2012, Ministry of Agriculture, Government of India
Rainfall	Indian Meteorological Department
Secondary school enrolment (% of population aged 15 and over) Tertiary education enrolment (% of population aged 20 and over)	Barro-Lee dataset 2011
Gross fixed capital formation(as % of GDP)	World Development Indicators (WDI), World Bank
Number of workers in organised manufacturing	Annual Survey of Industries (ASI), various reports
Road density (per 1000 kms)	Ministry of Transport and Highways, Government of India
Man-days lost due to strikes and lockouts	Labour Bureau, Government of India

Table A4.2: GLS Estimation Results, Agricultural sector (with other trade variable)

Independent Variable	Coefficient (Prais-Winsten method) 1982-2006
$\Delta LAGDP_{t-1}$	
$\Delta Laimport_t$	-0.01
$\Delta Lcredit_t$	-0.02
$\Delta Lirrigation_t$	0.01
$\Delta Acapital_t$	-1.21**
$\Delta fertilizer_t$	0.04
TOT_t	-0.01
$Lrainfall_t$	0.42***
dummy91	0.04
constant	-2.24***
	$R_{2=}0.77$ rho=-0.41

Note: Heteroskedasticity robust standard errors have been used. $LAGDP_{t-1}$ stands for the lagged dependent variable. The variable, "aimport" is agricultural raw material imports (% of merchandise imports). *, ** and *** indicate statistical significance at 10%, 5% and 1% level respectively.

Table A4.3: OLS and GLS Estimation Results, Manufacturing sector (with other trade variable)

Independent Variable	Coefficients (Prais-Winsten Regression) 1960-2011	Coefficients (Prais-Winsten Regression) 1979-2008
$\Delta LMGDP_{t-1}$		0.31**
$\Delta Ltrade2_t$	0.01	-0.01
$\Delta Lsenrol_t$		-0.10
$\Delta Lcapital_t$		0.15
$\Delta Llabour_t$		0.53***
$\Delta Lroad_t$		0.20
$\Delta Llmr_t$		-0.09
$\Delta LCredit_t$		-0.25
Dummy91		-0.00
constant	0.06***	0.06
	R^2=0.01 rho=0.24	R^2=0.75 rho=-0.53

Note: trade2 stands for merchandise trade (as % of total GDP).

Table A4.4: State-wise registered manufacturing GSDP growth (in %)

STATES	1980-89	1990-99	2000-09
ANDHRA PRADESH	10.02	6.26	8.50
Assam	4.13	-0.01	2.86
BIHAR	7.50	3.24	2.25
DELHI	8.84	2.17	4.64
GOA	9.36	6.47	2.33
GUJARAT	8.98	12.99	10.77
HARYANA	8.61	6.78	8.18
HIMACHAL PRADESH	20.36	10.92	6.93
KARNATAKA	9.12	6.82	11.45
KERALA	4.96	10.33	5.98
MADHYA PRADESH	6.80	7.68	7.74
MAHARASHTRA	6.93	20.15	12.64
MEGHALAYA	9.44	-3.22	36.18
ORISSA	13.43	6.40	18.95
PUNJAB	9.42	8.27	7.39
RAJASTHAN	8.64	8.03	7.47
TAMIL NADU	6.78	4.55	7.40
UTTAR PRADESH	13.46	3.01	9.54
WEST BENGAL	2.75	6.06	4.32

Source:- Authors' own calculation using data from EPWRF. The new states, Jharkhand, Uttarakhand and Chhattisgarh have been clubbed with their parent states.

Table A4.5: State-wise unregistered manufacturing GSDP growth (in %)

STATES	1980-89	1990-99	2000-09
ANDHRA PRADESH	4.63	7.91	5.11
ASSAM	0.50	2.13	6.31
BIHAR	4.14	-5.16	5.87
DELHI	7.12	10.00	8.20
GOA	-11.36	8.22	6.82
GUJARAT	7.28	8.06	8.23
HARYANA	16.98	5.51	6.66
HIMACHAL PRADESH	5.81	8.21	7.21
KARNATAKA	4.33	5.37	5.26
KERALA	-0.29	1.68	5.57
MADHYA PRADESH	3.32	7.49	2.83
MAHARASHTRA	4.90	9.91	7.75
MEGHALAYA	4.15	1.93	5.20
ORISSA	2.90	8.13	6.76
PUNJAB	8.75	8.64	4.65
RAJASTHAN	4.75	3.53	7.79
TAMIL NADU	0.57	2.97	3.47
UTTAR PRADESH	5.66	3.86	6.54
WEST BENGAL	4.01	5.88	6.20

Source:- Authors' own calculation using data from EPWRF. The new states, Jharkhand, Uttarakhand and Chhattisgarh have been clubbed with their parent states.

Table A4.6: Data source for Chapter 4.2

Variable	Variable Source
Manufacturing GSDP	EPW Research Foundation. Accessed at www.epwrfits.in
Enrolment ratio in middle school	Selected Educational Statistics, Ministry of Human Resource Development, Government of India
Number of mandays (in 1000s) lost	Ministry of Labour and Employment, Government of India
Road density and Electricity	Centre for Monitoring Indian Economy (CMIE)
Industrial credit	CMIE
Tariff and exports	WITS
State level industrial output, Manufacturing (gross value added)	Annual Survey of Industries (Various Years), Ministry of statistics and programme implementation, Government of India

Table A4.1: List of states

List of States	
Andhra Pradesh	Punjab
Assam	Rajasthan
Bihar	Tamil Nadu
Gujarat	Uttar Pradesh
Haryana	West Bengal
Karnataka	Delhi
Kerala	Goa
Madhya Pradesh	Himachal Pradesh
Maharashtra	Meghalaya
Orissa	

Note: Jharkhand, Chhattisgarh and Uttaranchal have been clubbed with Bihar, MP and UP for all the years. The remaining states and union territories could not be included because of unavailability of data.

Table A4.8: NIC 1987 at 2 digit industry level

Sections 2 and 3-Manufacturing	**Description**
Division 20-21	Manufacture of food products
Division 22	Manufacture of beverages, tobacco and related products
Division 23	Manufacture of cotton textiles
Division 24	Manufacture of wool silk and man-made fibre textiles
Division 25	Manufacture of jute and other vegetable fibre textiles (except cotton)
Division 26	Manufacture of textile products (including wearing apparel)
Division 27	Manufacture of wood and products of wood; furniture and fixtures
Division 28	Manufacture of paper and paper products and printing, publishing and allied industries
Division 29	Manufacture of leather and leather products, fur and substitutes of leather
Division 30	Manufacture of basic chemicals and chemical products (except products of petroleum and coal)
Division 31	Manufacture of rubber, plastic, petroleum and coal products; processing of nuclear fuels
Division 32	Manufacture of non-metallic mineral products
Division 33	Basic metal and alloys industries
Division 34	Manufacture of metal products and parts, except machinery and equipment
Division 35-36	Manufacture of machinery and equipment other than transport equipment (manufacture of scientific equipment, photographic/cinematographic equipment and watches and clocks is classified in div. 38)
Division 37	Manufacture of transport equipment and parts
Division 38	Other manufacturing industries

Source: Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Govt. of India.

Chapter 5: Growth effects and determinants of public education expenditure in India: Analysis at the Disaggregated Level

Chapter 5.1: Public Education Expenditure and Economic Growth of India: Analysis at the Disaggregated Level

5.1.1 Introduction and Background

Immediately after independence, the government of India focused more on tertiary education and, as a result, education at the school level was neglected (De and Endow, 2008). This was because the government gave relatively more emphasis to industrial sector development compared to that of agriculture from the second five year plan (starting from 1956). As seen in Table 5.1 below, average share of tertiary education expenditure in total education expenditure kept on increasing through the three decades, 1951-1980. At the same time, primary education expenditure share showed a downward trend.

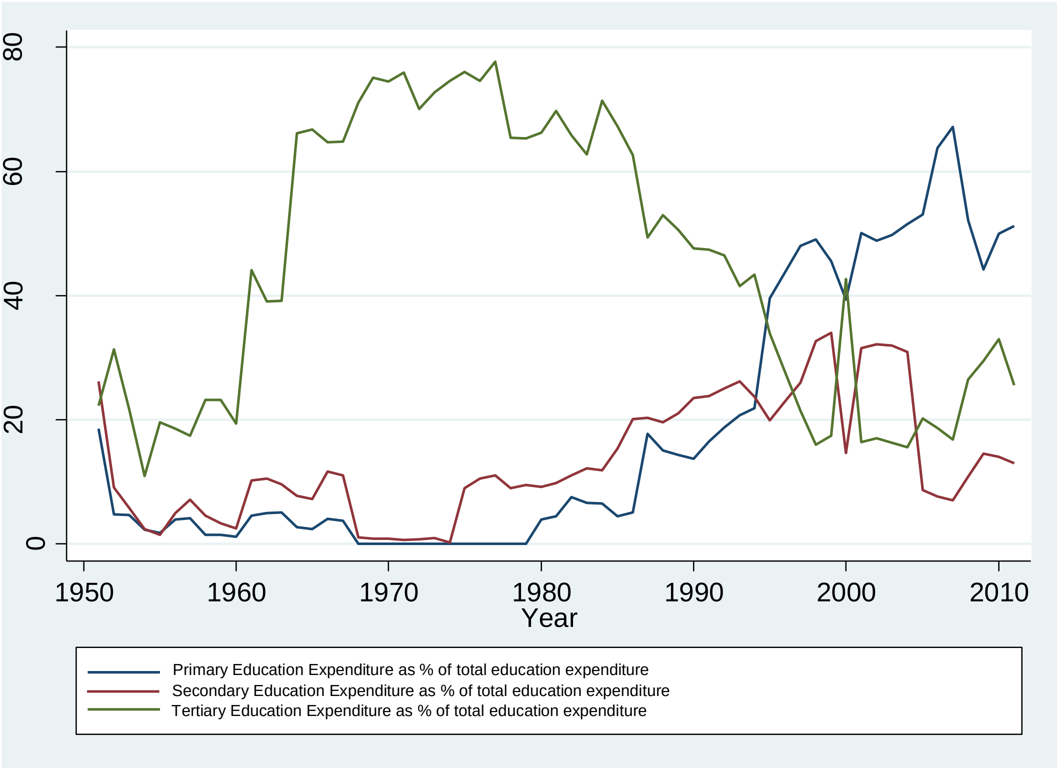
Table 5.1: Sectoral Education Expenditure as share of Total Education Expenditure

Year	Primary Education Expenditure Share (%)	Secondary Education Expenditure Share (%)	Tertiary Education Expenditure Share (%)
1951-1960	4.43	6.73	20.75
1961-1970	1.7	2.73	60.54
1971-1980	0.4	6.09	71.84
1981-1990	9.56	16.49	60.01
1991-2000	29.6	24.88	33.78
2001-2011	52.89	18.38	21.4

Source: Authors' own calculations based on data from MHRD and RBI database.
Note: All expenditure presented here is by the education department of central government of India. Tertiary education expenditure includes university/higher education expenditure and technical education expenditure. Expenditure share of primary, secondary and tertiary education sectors do not add up to 100 because other categories such as vocational and 'other' education have not been included.

The Constitution of India listed education as a state subject (Article 45) and the responsibility of financing school education rested largely on the state governments. However, without the active support of the central government, the target put down by the Indian Constitution of achieving ‘Universal Elementary Education’ (UEE) remained an empty rhetoric (MHRD, 1997). In 1976, education was transferred to the concurrent list (i.e. joint responsibility of the state and central government) and after the implementation of National Policy on Education (NEP) in 1986, the share of primary education gradually started to increase in the central budget. Since then, there has been significant quantitative increase in education spending especially at the primary level (from 0.4% of total education spending during 1971-1980 to about 52.89% during 2001-2011).

Figure 5.1: Sectoral Education Expenditure as % of Total Education Expenditure



Source:- Author’s own calculation based on MHRD data.
Note: Tertiary education expenditure includes university/higher education expenditure and technical education expenditure. Expenditure share of primary, secondary and tertiary education sectors do not add up to 100 because other categories such as vocational and ‘other’ education have not been included.

Budgetary allocations to secondary education by the central government do not show any systematic pattern. The relative importance of secondary education increased once the National Policy of Education (1966) laid emphasis on school education observing the growth of educated unemployment among educated youth and the mismatches in the labour market (Tilak, 2005).

In this context, the study aims to answer the following empirical question: which sectoral expenditure in education, if any, has been effective in promoting growth in India? The rest of the article is structured as follows. Section 5.1.2 reviews the relevant literature, Section 5.1.3 discusses the model and data, Section 5.1.4 presents the results and Section 5.1.5 concludes.

5.1.2 Review of the Literature

The literature on the aggregate education expenditure and economic growth link has been discussed in detail in chapter 3. Here, given the scope of the chapter, I choose to focus only on the past studies examining the empirical relationship between education expenditure in different education sectors and economic growth.

Devarajan et al. (1996) examine the composition effect of public expenditure on economic growth using data on a sample of 43 developing countries and find that school and tertiary education expenditure has no effect on growth; only the category, 'other education' which includes subsidiary services to education, exert positive growth effects. They argue that such outcome can be due to distortions and misallocation of resources in the developing country markets. Aghion et al. (2009) find that the effectiveness of education investments in different sectors vary across US states according to the technology level or technological environment in each state. They observe that only in technically advanced US states, an exogenous shock to four-year college education and research education has positive growth effects. Whereas for a technologically less advanced state, four-year college education and research education have statistically insignificant and negative effects respectively. Solaki (2013) employs co-integration analysis and finds a positive effect of tertiary education expenditure on the economic growth of Greece during 1961-2006. Primary and secondary education expenditures do not seem to have any impact.

It seems that most past studies use rate of return to education or enrolment ratios as proxy for education. Boldin et al. (1996) employ Granger Causality Analysis for the time period 1960-1996 and find that higher education enrolment has a positive effect on GDP growth in Brazil whereas for Chile there was no impact. Jaoul (2004) analyses the higher education-growth link for France and Germany before the Second World War and observe that higher education (measured by total number of students in arts, law, medical science and other sciences) positively influenced economic growth of France. However, this phenomenon was not observed in Germany. Kui (2006) does a co-integration analysis and reports that economic development is the cause of higher education and result of primary education in China during 1978-2004. Dănăcică et al. (2010) find that higher education enrolment ratio has no effect on economic growth of Romania.

The existing Indian studies have also evaluated the effectiveness of sectoral education spending using enrolment ratio or rate of return. Self and Grabowski (2004) found secondary education (measured in terms of enrolment) to be positively correlated with economic growth of India. Haldar and Mallik (2010) report that the stock of human capital, measured by primary gross enrolment rate (lagged by three years), has a significant effect on growth of per capita GNP. Mathur and Mamgain (2004) observe significantly increasing effects of education on economic growth of Indian states (NSDP per capita) by increasing levels of education. They show that the higher education has the highest growth effects followed by higher secondary education. Studies, attempting to evaluate the rate of return to education in

India, also found that overall education is beneficial for growth (Harberger, 1965; Nalla-Gounden, 1967; Tilak, 1990). [46]

To the best of my knowledge, no major work exists on the sectoral education expenditure-growth link for India. Thus, this study will add to the existing literature by researching in this direction.

5.1.3 Model Formulation and Variable Description

I employ the same model used in Chapter 3-the Augmented Solow Model- to examine the relationship between sectoral education expenditure and growth. In this model, the output or GDP is a function of education expenditure, trade openness, physical capital accumulation and size of labour force. All variables are in their natural logarithms except physical capital since the variable is expressed as a percentage of GDP (value lies between 0 and 1). Primary, secondary and tertiary education expenditures enter the model separately. The model is expressed as follows.

$$LGDP_t=\beta_0+ \beta_1 LPrimary_t+ \beta_2 LTrade_t+ \beta_3 PCapital_t+ \beta_4 LLabour_t +e_t \quad (1)$$

$$LGDP_t=\beta_0+ \beta_1 LSecondary_t+ \beta_2 LTrade_t+ \beta_3 PCapital_t+ \beta_4 LLabour_t +e_t \quad (2)$$

$$LGDP_t=\beta_0+ \beta_1 LTertiary_t+ \beta_2 LTrade_t+ \beta_3 PCapital_t+ \beta_4 LLabour_t +e_t \quad (3)$$

where, at time t

GDP=GDP at factor cost (constant 2004 prices, Rs billion),

Primary= Public Primary education expenditure (constant 2004 prices, Rscrore),[47]

Secondary= Public Secondary education expenditure (constant 2004 prices, Rscrore),

[46] For further discussion of the theoretical as well as empirical literature on education-growth link, see Carnoy (2006).

[47] 1 crore=10 million

Tertiary= Public Tertiary education expenditure (constant 2004 prices, Rscrore),

Trade=exports and imports as percentage of GDP,

PCapital= proxy for physical capital defined as gross capital formation as percentage of GDP (both in 2004 constant prices),

Labour= size of labour force from RBI[48] and

e= error term.

5.1.4 Results and Discussion

Initially, I start with a simplified model where I do a bivariate analysis with GDP and education expenditure in order to establish the direction of causality. One of the main reasons for doing this exercise before estimating the full model is that data on trade openness is available from 1960 onwards whereas we have data on education expenditure and GDP from 1951 onwards. So I did not want to lose observations. Secondly, I wanted to examine whether a long run relationship exists between only education expenditure in any sector (primary variable of interest) and GDP. However, Johansen test for co-integration indicates that there is no long run relationship between primary, secondary or tertiary expenditure and growth. Hence, I employ Vector Autoregression (VAR) method to estimate the short run relationship. I work with the variables in their first difference because ADF test indicates that all the variables are I(1) (see Table A5.2 in the Appendix). The equations estimated are as follows:

$$\Delta LGDP_t=\beta_0+ \beta_1\Delta LPrimary_t+ e_t \qquad (4)$$

$$\Delta LGDP_t=\beta_0+ \beta_1\Delta LSecondary_t+u_t \qquad (5)$$

$$\Delta LGDP_t=\beta_0+ \beta_1\Delta LTertiary_t+\mu_t \qquad (6)$$

[48] See Table A5.1 in the Appendix for data sources.

where, e, u and μ are the error terms.

The findings presented in the tables (5.2-5.4) below indicate that none of sectoral education expenditure has any effect on GDP growth for the time period 1954-2011. Only, secondary education expenditure affects growth negatively with a year lag. But the overall effect of this variable is insignificant. There is evidence of reverse causality from GDP growth to growth in primary education expenditure (see the Impulse Response Graph, Figure A5.1, also in the Appendix).

Table 5.2: VAR Results with Primary Education Expenditure, 1954-2011

Dependent Variable	**Independent Variable**	**Coefficient**
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ $\Delta LPrimary_{t-1}$ $\Delta LPrimary_{t-2}$ Trend Constant	-0.26*** -0.10 0.00 -0.00 0.00*** 0.03***
$\Delta LPrimary_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ $\Delta LPrimary_{t-1}$ $\Delta LPrimary_{t-2}$ Trend Constant	-13.78*** -1.2 -0.00 0.02 0.02** 0.37
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.13 H_0 : No Autocorrelation at lag order 2 P-value=0.13	**Granger Causality Test** H_0: $\Delta LPrimary_t$ does not cause $\Delta LGDP_t$ P-value=0.83 H_0: $\Delta LGDP_t$ does not cause $\Delta LPrimary_t$ P-value=0.00	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively.

Table 5.3: VAR Results with Secondary Education Expenditure, 1954-2011

Dependent Variable	**Independent Variable**	**Coefficient**
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ Δ $LSecondary_{t-1}$ Δ $LSecondary_{t-2}$ Trend Constant	-0.23* -0.17 -0.01** 0.00 0.00*** 0.03***
$\Delta LSecondary_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ Δ $LSecondary_{t-1}$ Δ $LSecondary_{t-2}$ Trend Constant	-5.92* 1.35 -0.10 -0.11 0.00 0.28
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.29 H_0 : No Autocorrelation at lag order 2 P-value=0.97	**Granger Causality Test** H_0 : $\Delta LSecondary_t$ does not cause $\Delta LGDP_t$ P-value=0.11 H_0 : $\Delta LGDP_t$ does not cause $\Delta LSecondary_t$ P-value=0.16	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively.

Table 5.4: VAR Results with Tertiary Education Expenditure, 1954-2011

Dependent Variable	**Independent Variable**	**Coefficient**
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ $\Delta LTertiary_{t-1}$ $\Delta LTertiary_{t-2}$ Trend Constant	-0.25** -0.10 -0.00 -0.02 0.00*** 0.03***
$\Delta LTertiary_t$	$\Delta LGDP_{t-1}$ $\Delta LGDP_{t-2}$ $\Delta LTertiary_{t-1}$ $\Delta LTertiary_{t-2}$ Trend Constant	1.69 0.83 -0.35*** -0.28** -0.00* 0.27***
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.11 H_0 : No Autocorrelation at lag order 2 P-value=0.72	**Granger Causality Test** H_0 : $\Delta LTertiary$ does not cause $\Delta LGDP$ P-value=0.34 H_0 : $\Delta LGDP$ does not cause $\Delta LTertiary$ P-value=0.39	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively.

All the VAR systems satisfy stability conditions (see Figures A5.2a, b and c in the Appendix for the VAR systems for primary, secondary and tertiary expenditure respectively). The finding, that none of the education expenditure categories have any significant effect on growth, is upheld even when we re-estimate the relationship using the fully specified model (Equations 1-3). The results are reported in the following tables 5.5-5.7.

Table 5.5: Fully specified VAR Model Estimation with Primary Education Expenditure, 1962-2011

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LPrimary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.22* 0.00 0.09** 0.04 -1.05** 0.04*** 0.02**
$\Delta LPrimary_t$	$\Delta LGDP_{t-1}$ $\Delta LPrimary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-17.25*** 0.02 0.10 2.58 18.21 0.02** 0.23**
$\Delta LTrade_t$	$\Delta LGDP_{t-1}$ $\Delta LPrimary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.47 0.00 -0.02 1.16** 0.00* -0.07* -0.03
$\Delta PCapital_t$	$\Delta LGDP_{t-1}$ $\Delta LPrimary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	0.10 0.00 -0.02 -0.36*** 0.10 0.00 -0.01
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.99	**Granger Causality Test** H_0 : $\Delta LPrimary_t$ does not cause $\Delta LGDP_t$ P-value=0.37 H_0 : $\Delta LGDP_t$ does not cause $\Delta LPrimary_t$ P-value=0.00	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. LLabour enters the model as an exogenous variable. Optimal Number of Lags=1 as per AIC. The VAR system is stable. See Figure A5.3a in the Appendix.

Table 5.6: Fully specified VAR Model Estimation with Secondary Education Expenditure, 1962-2011

Dependent Variable	**Independent Variable**	**Coefficient**
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LSecondary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.16 -0.01 0.10** -0.02 -0.92** 0.00 0.04*** 0.04**
$\Delta LSecondary_t$	$\Delta LGDP_{t-1}$ $\Delta LSecondary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-5.88* -0.17 0.66 -3.43 18.21 16.54 0.00 -0.06
$\Delta LTrade_t$	$\Delta LGDP_{t-1}$ $\Delta LSecondary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.57 0.02 -0.04 1.27** 2.57* 0.00** -0.07* -0.03
$\Delta PCapital_t$	$\Delta LGDP_{t-1}$ $\Delta LSecondary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	0.09 0.00 -0.02 -0.36*** 0.09 0.00 -0.01 -0.01
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.87	**Granger Causality Test** H_0 : $\Delta LSecondary_t$ does not cause $\Delta LGDP_t$ P-value=0.19 H_0 : $\Delta LGDP_t$ does not cause $\Delta LSecondary_t$ P-value=0.10	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. LLabour enters the model as an exogenous variable. Optimal Number of Lags=1 as per AIC. The VAR system is stable. See Figure A5.3b in the Appendix.

Table 5.7: Fully specified VAR Model Estimation with Tertiary Education Expenditure, 1962-2011

Dependent Variable	Independent Variable	Coefficient
$\Delta LGDP_t$	$\Delta LGDP_{t-1}$ $\Delta LTertiary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.21 -0.00 0.09** 0.02 -1.01** 0.00 0.04***
$\Delta LTertiary_t$	$\Delta LGDP_{t-1}$ $\Delta LTertiary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	1.93 -0.25** 0.26 3.43** -3.20 -0.01* 0.30**
$\Delta LTrade_t$	$\Delta LGDP_{t-1}$ $\Delta LTertiary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	-0.38 -0.06 -0.02 1.02* 2.53* 0.00 -0.05
$\Delta PCapital_t$	$\Delta LGDP_{t-1}$ $\Delta LTertiary_{t-1}$ $\Delta LTrade_{t-1}$ $\Delta PCapital_{t-1}$ $\Delta LLabour_t$ Trend Constant	0.10 0.00 -0.02 -0.36*** 0.12 0.00 -0.01
LM Test for Autocorrelation H_0 : No Autocorrelation at lag order 1 P-value=0.98	**Granger Causality Test** H_0 : $\Delta LTertiary_t$ does not cause $\Delta LGDP_t$ P-value=0.83 H_0 : $\Delta LGDP_t$ does not cause $\Delta LTertiary_t$ P-value=0.12	

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. LLabour enters the model as an exogenous variable. Optimal Number of Lags=1 as per AIC. The VAR system is stable. See Figure A5.3c in the Appendix.

There can be many reasons why education may not have the desired positive effect on growth. Blankenau et al. (2007) argue that the government can increase taxes in order to finance rising education expenditure. In that case, the negative tax effects may offset the positive education spending effect. Krueger and Lindahl (2000) say that a country which is improving its education policy is likely to change or improve other economic policies as well which will enhance its growth. In that case, it can be very difficult to separate the effect of education policy from that of the other policies. Goel (1974) argues that most of the increase in the education expenditure in India has gone into quantitative expansion (for example, like building more schools without investing in qualitative programmes like teachers' training) rather than qualitative improvements. [49]Devarajan et al. (1996) show that the supposed link between public expenditure and growth is not observed in case of developing countries. They show that capital expenditure in education do not have any effect on growth which probably is an indication of misallocation of resources in developing countries.

However, it is not that public education expenditure has played absolutely no role in the Indian growth process. It seems that the nature of the relationship between education expenditure and economic growth changed once the Indian economy started to move from a state-led growth model towards a pro-business model since 1980s (see Tables 5.12-5.14 below). Hence, the lack of a relation between education expenditure and growth, when examined for the entire period of 60 years after independence, can probably be attributed to the labour market characteristics and institutional structure of the Indian economy till the 1970s. As mentioned previously, during the first three decades after independence, the focus of the Indian policymakers was to achieve growth with social justice following a state-led growth model. The public sector was the key player in the economy. Till 1970s, policy regulations in the Indian economy gave ample opportunities for rent-seeking in both private

[49] The paper observes that although the education expenditure as a proportion of the national income rose from 1.3% in 1951-52 to 2.9% in 1967-68, the direct per capita expenditure on either primary or middle or secondary or higher education has not increased in the same proportion as the per capita income at current prices, which increased by 110.4% during the period 1951-52 to 1967-68. The teacher-pupil ratio, which is often used as an index of efficiency of an education system, had deteriorated at all the levels of education. The expenditure incurred on training a teacher had also gone down during the aforesaid time period. There was around 33.2% reduction in the per capita investments in training college teachers.

and public sector, especially for large enterprises. Moreover, because of the rigid labour laws it was not easy to fire employees, especially in the public sector. Hence there was a tendency among the companies to hire fewer employees on long term contracts. As a result, the unemployment among graduates in India was quite high. Further, there was clear evidence of rent extraction. In the OECD countries the average wage in the public sector is about 50% higher than per capita GDP whereas in India it was four times as high (Pissarides, 2000). Apart from this, there are many other benefits attached to a public sector job, such as subsidised housing. On an average, public enterprises in India pay twice the average wage of private enterprises, despite the fact that they employ on average a less qualified work force which leads to misallocation of resources. In 1994, of those who succeeded in the civil service examinations for a job in public administration, 38% were qualified engineers and 5.5% qualified doctors. So, the market structure was such that it was encouraging skilled workers to engage in unproductive activities and probably reduced the effectiveness of public education expenditure during the 1950s, 60s and 70s. For example, if the research sector is underdeveloped, as was the case of India, then the prospective researchers will either migrate to other countries or will engage in rent-seeking activities. If property rights are not respected and innovations are not protected via patents then entrepreneurs cannot keep the profits out of the innovations done in their organisations. Consequently, entrepreneurship will be discouraged and skilled workers, in spite of having the expertise, will not engage in innovative activities. On the other hand, when the markets in a country are large and the people are encouraged to open their own businesses and are allowed to keep their profits, then many talented people get attracted towards entrepreneurship. The prime example of such behaviour is the Great Britain during the Industrial Revolution. The structure of the labour market is therefore vital for the determination of the productivity of human capital. In other words, the labour market in an economy decides the type of use its human capital is put to. It determines that what proportion of the human capital is put into growth-enhancing activities and how much into non-productive activities such as pure rent seeking. The paper, Murphy et al. (1991), is quite useful to understand this concept. The paper says that markets demanding more civil servants and fewer engineers will not have the same outcome from investing in education as that of a market which encourages more engineering graduates. It shows that countries with more engineers grow faster whereas those with more lawyers grow comparatively at a slower rate. The paper shows, using cross-country data, that there is a positive and significant effect of engineers on growth and a negative and insignificant effect of lawyers on growth.[50]

As discussed in detail in Chapter 3, India began to move towards an open and liberal regime since 1980-81 onwards. There was a clear shift in industrial policies in favour of a market-led growth through domestic decontrols as the country faced stagnating industrial growth during the late 1970s. Many past studies have shown that a major structural break in India's growth occurred around 1980 when the average growth rate of GDP increased considerably above that experienced till 1970s (Wallack, 2003; Sinha and Tejani, 2004; Rodrik and Subramanian, 2004).

[50] In the Lucas growth model (1988), people divide their time between work and further skill accumulation (research and training). One implication of this model is that the choice, which skilled workers in an economy make between growth enhancing activities or rent-seeking activities, depends on the dynamic features of that economy to a large extent.

Table 5.8: Average Annual GDP Growth Rate of India

Time Period	Growth Rate (%)
1951-1960	3.67
1961-1970	3.38
1971-1980	2.97
1981-1990	4.80
1991-2000	5.56
2001-2011	7.06

Note: Author's own calculations based on GDP data from RBI database.

Once these regime changes in the Indian economy are accounted for, education expenditure shows a clear effect on GDP growth. There were two such regime changes in the Indian economy. One in 1980-when India started to undertake various industrial reforms; the other in 1991 when India embraced widespread trade reforms. Accordingly, I create period dummies for post-1980 and post-1991 time periods and first assess whether these dummies have any impact on Indian GDP growth using the following estimating equation.

$$\Delta LGDP_t=\beta_0+ \beta_1\Delta LPrimary_t+ \beta_2\Delta LTrade_t+ \beta_3\Delta PCapital_t+ \beta_4\Delta LLabour_t + \beta_5 dummy80 + \beta_6 dummy91+ e_t \qquad (7)$$

where, dummy80=period dummy for post-1980 period which takes a value 1 since 1980 onwards and 0 otherwise and dummy91= period dummy for post-1991period which takes a value 1 since 1991 onwards and 0 otherwise.

Similarly, the equations with secondary and tertiary education will be specified. The OLS estimation results are presented in Tables 5.9-5.11. We employ OLS in this case because our model does not seem to suffer from the problem of reverse causality bias since GDP does not cause trade, physical capital, and secondary and tertiary education expenditures (as seen from the results presented in Tables 5.5-5.7). There was only some evidence of reverse causality in case of primary education. Hence, I re-estimate Equation 7 using Instrumental Variable (IV) GMM Estimation method where 'Lprimary' is instrumented using first and second year lagged values. GMM results indicate that 'Lprimary' can actually be treated as exogenous in our model. Nonetheless, I report both the OLS and GMM findings in Table 5.9 to show that the findings are consistent across the estimation procedures. In case of the OLS estimation, Ramsey Reset Test indicates that our model is correctly specified and Portmanteau Test for white noise establishes that there is no problem of autocorrelation.

Table 5.9: OLS and IV GMM Estimation Results with Primary Education Expenditure, 1961-2011

Variable	OLS Estimation Results			IV GMM Results
$\Delta LPrimary_t$	0.00	0.00	0.00	-0.01
$\Delta LTrade_t$	-0.02	-0.06	-0.04	-0.02
$\Delta PCapital_t$	0.04	0.01	0.02	-0.01
$\Delta LLabour_t$	-0.61	-0.03	-0.41	-0.35
dummy80	0.03***		0.02*	0.03*
dummy91		0.03***	0.01	0.00
constant	0.04***	0.04***	0.04***	0.03***
	R^2=0.25 **Ramsey RESET test** H_0: No omitted variable P-value=0.67 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.70	R^2=0.20 **Ramsey RESET test** H_0: No omitted variable P-value=0.48 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.78	R^2=0.26 **Ramsey RESET test** H_0: No omitted variable P-value=0.94 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.72	R^2= 0.15 **Endogeneity Test** H_0:$\Delta LPrimary_t$ is exogenous P-value=0.47

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

After 1980, growth rate of GDP accelerated by around 3 percentage points. The 1991 period dummy also comes out with a coefficient of similar size and similar level of significance but it becomes insignificant once we include the 1980 period dummy which implies that incorporating the post-1980 dummy is enough to account for the regime change. The tables

5.10 and 5.11 present estimation results of Equation 7 with secondary and tertiary education expenditure respectively. [51]

Table 5.10: OLS Estimation Results with Secondary Education Expenditure, 1961-2011

Variable	**OLS Estimation Results**		
$\Delta LSecondary_t$	0.01	0.01*	0.01
$\Delta LTrade_t$	-0.05	-0.07	-0.05
$\Delta PCapital_t$	0.05	0.04	0.05
$\Delta LLabour_t$	-0.38	0.00	-0.40
dummy80	0.004***		0.004***
dummy91		0.003***	-0.00
constant	0.04***	0.04***	0.04***
	R^2=0.33 **Ramsey RESET test** H_0: No omitted variable P-value=0.64 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.68	R^2=0.24 **Ramsey RESET test** H_0: No omitted variable P-value=0.96 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.82	R^2=0.33 **Ramsey RESET test** H_0: No omitted variable P-value=0.95 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.68

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

[51] I do not re-estimate the equations with secondary and tertiary education variables with GMM method because there was no evidence of reverse causality from GDP towards these variables.

Table 5.11: OLS Estimation Results with Tertiary Education Expenditure, 1961-2011

Variable	OLS Estimation Results		
$\Delta LTertiary_t$	0.01	0.01	0.01
$\Delta LTrade_t$	-0.05	-0.07	-0.05
$\Delta PCapital_t$	-0.01	-0.00	0.01
$\Delta LLabour_t$	-0.16	0.21	-0.18
dummy80	0.004***		0.004***
dummy91		0.002***	-0.00
constant	0.03**	0.03***	0.03***
	R^2=0.30 **Ramsey RESET test** H_0: No omitted variable P-value=0.76 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.40	R^2=0.22 **Ramsey RESET test** H_0: No omitted variable P-value=0.83 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.62	R^2=0.30 **Ramsey RESET test** H_0: No omitted variable P-value=0.71 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.40

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

There is some evidence that secondary education expenditure has a positive effect on growth but this effect is fragile and sensitive to model specifications and estimation methods. In the VAR estimation, this positive effect does not show up. Next, I interact the variables primary, secondary and tertiary education expenditure with the 1980 period dummy and re-estimate our model by incorporating these interaction variables into our model. Further, I include a lagged dependent variable. The new model looks as follows:

$$\Delta LGDP_t=\beta_0+\beta_1\Delta LGDP_{t-1}+\beta_2\Delta LGDP_{t-2}+\beta_3\Delta LPrimary_t+\beta_4\Delta LTrade_t+\beta_5\Delta PCapital_t+ \beta_6\Delta LLabour_t + \beta_7 Primary80+ e_t \quad (8)$$

$$\Delta LGDP_t=\beta_0+\beta_1\Delta LGDP_{t-1}+\beta_2\Delta LGDP_{t-2}+\beta_3\Delta LSecondary_t+\beta_4\Delta LTrade_t+\beta_5\Delta PCapital_t+ \beta_6\Delta LLabour_t + \beta_7 Secondary80+ e_t \quad (9)$$

$$\Delta LGDP_t=\beta_0+\beta_1\Delta LGDP_{t-1}+\beta_2\Delta LGDP_{t-2}+\beta_3\Delta LTertiary_t+\beta_4\Delta LTrade_t+\beta_5\Delta PCapital_t+ \beta_6\Delta LLabour_t + \beta_7 Tertiary80+ e_t \quad (10)$$

where, Primary80=interaction variable, Primary education expenditure*dummy80,

Secondary80=interaction variable, Secondary education expenditure*dummy80 and

Tertiary80=interaction variable, Tertiary education expenditure*dummy80,

We estimate the final model (Equations 8-10) using both OLS and Prais-Winsten Regression methods. My model does not suffer from autocorrelation problem (as evident from the Portmanteau Test results) so OLS should suffice. However, I still apply Generalized Least Squares (GLS) method to my model to check the robustness of my findings to different estimation procedures. Tables 5.12-5.14 below present the results obtained by estimation of equations 8-10.

Table 5.12: OLS and Prais-Winsten Regression Results with Primary80, 1961-2011

Variable	**OLS Estimation Results**	**Prais-Winsten Regression Results**
$\Delta LGDP_{t-1}$	-0.31*	-0.62***
$\Delta LGDP_{t-2}$	-0.22	-0.38***
$\Delta LPrimary_t$	-0.00	-0.00
$\Delta LTrade_t$	-0.05	-0.09
$\Delta PCapital_t$	0.04	-0.01
$\Delta LLabour_t$	-0.42	-0.65
Primary80	0.01***	0.01***
constant	0.06**	0.08***
	R^2=0.37 **F Test of Significance** H_0:Primary80=0 P-value=0.00 **Ramsey RESET test** H_0: No omitted variable P-value=0.14 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.79	R^2=0.46 **F Test of Significance** H_0:Primary80=0 P-value=0.00

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

Table 5.13: OLS and Prais-Winsten Regression Results with Secondary80, 1961-2011

Variable	OLS Estimation Results	Prais-Winsten Regression Results
$\Delta LGDP_{t-1}$	-0.17	-0.50***
$\Delta LGDP_{t-2}$	-0.20	-0.37***
$\Delta LSecondary_t$	0.01	0.00*
$\Delta LTrade_t$	-0.04	-0.07**
$\Delta PCapital_t$	0.10	0.03
$\Delta LLabour_t$	-0.67	-0.98
Secondary80	0.004***	0.01***
constant	0.06**	0.08**
	R^2=0.35 **F Test of Significance** H_0:Secondary80=0 P-value=0.00 **Ramsey RESET test** H_0: No omitted variable P-value=0.40 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.96	R^2=0.48 **F Test of Significance** H_0:Primary80=0 P-value=0.00

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

Table 5.14: OLS and Prais-Winsten Regression Results with Tertiary80, 1961-2011

Variable	OLS Estimation Results	Prais-Winsten Regression Results
$\Delta LGDP_{t-1}$	-0.22*	-0.57***
$\Delta LGDP_{t-2}$	-0.15	-0.34***
$\Delta LTertiary_t$	0.01	0.01
$\Delta LTrade_t$	-0.04	-0.08**
$\Delta PCapital_t$	0.11	0.04
$\Delta LLabour_t$	-0.59	-0.80
Tertiary80	0.004***	0.01***
constant	0.05**	0.08***
	R^2=0.33 **F Test of Significance** H_0:Tertiary80=0 P-value=0.48 **Ramsey RESET test** H_0: No omitted variable P-value=0.14 **Portmanteau Test** H_0: No Autocorrelation P-value= 0.76	R^2=0.44 **F Test of Significance** H_0:Primary80=0 P-value=0.00

Note: Dependent Variable=$\Delta LGDP_t$. ***, ** and * indicate statistical significance at 1%, 5% and 10% level respectively. Heteroskedasticity robust standard errors have been used.

A 1 percentage point increase in growth rate of primary education expenditure is expected to raise GDP growth rate by 1 percentage points. Compared to this, the effect of secondary and tertiary expenditure is relatively smaller, as far as OLS estimation results are concerned. A similar increase in growth rate of either of secondary or tertiary expenditure raises GDP growth rate only by 0.004 percentage points. However, if we look at the Prais-Winsten estimates then the growth effect of expenditure in all sectors seem to be similar. The results give an overall impression that public education expenditure started to exert a positive impact (though the elasticities are not very large) on Indian GDP growth once the country introduced substantial industrial and trade reforms, started to encourage private sector participation and embraced globalisation. As a result, industrial and service sectors expanded creating more job opportunities and thus there was better utilisation of the educated labour pool. Prior to the 1980s, as discussed earlier, public sector was the predominant manipulator of the human capital in the Indian economy. Public sector jobs such as bureaucratic positions were the most attractive form of jobs which are highly unproductive and encourage rent-seeking. That is why, probably, we do not find any effect of any sectoral education expenditure on growth when we do the econometric analysis for the entire time period 1951-2011. However, as Indian economy started to become increasingly pro-business, the effect of education expenditure started to be felt as the human capital was put to better use. Moreover, as competition increased with increasing trade openness since 1991, companies were compelled to invest in innovation and thereby exploit the human resources more effectively. So, we see that primary, secondary and tertiary education expenditures influenced GDP growth positively since 1980.

The explaining power of the model improves once lagged dependent variables are included. The growth effect of trade openness during 1961-2011 is fragile which is consistent with the findings of the previous chapter. Maybe, there are measurement errors associated with the variable-physical capital and that is why we never get to observe the theoretical relationship between physical capital and growth in the empirical exercise (see Krueger and Lindahl, 2001 also). Both physical capital and labour force size do not seem to exert any meaningful effect on growth. Even if we drop these variables from our model, the findings stay unchanged.

5.1.5 Conclusion

The study tried to estimate the relationship between public primary, secondary and tertiary education expenditure and economic growth using time series econometric analysis for the time period 1951-2011. It seems that the nature of the relationship between education expenditure and growth changes following a regime change in the India since 1980. The econometric analysis indicates that all the sectoral education expenditures positively affect GDP growth from 1980 onwards. However, I find no effect if the analysis is conducted for the entire time period indicating an alteration in parameters across regimes.

In other words, public education expenditure started to exert a positive impact on Indian GDP growth once the country embraced substantial industrial reforms since 1980s, started to encourage private sector participation and eventually embraced globalisation since 1991onwards. As a result, industrial and service sectors expanded creating more job opportunities and thus there was better utilisation of the educated labour pool. Till 1970s, policy regulations in the Indian economy gave ample opportunities for rent-seeking, especially for large enterprises. Moreover, because of the rigid labour laws it was not easy to fire employees, especially in the public sector. Hence there was a tendency among the companies to hire fewer employees on long term contracts. As a result, the unemployment among graduates in India was quite high, thereby underutilising the available human capital. Bureaucratic jobs in the public sector were the most attractive form of jobs which are highly unproductive and encourage rent-seeking. That is why, probably, education expenditure did not have any effect on growth during 1951-1979 and this rendered the relationship for the entire time period 1951-2011 into being non-existent.

The findings also make the case stronger for the government involvement in India for funding both school and higher education. Undoubtedly, private sector should still be encouraged to invest in education because empirical evidence suggests that private schools are more efficient than public schools in imparting learning. However, since education is a ‘public good’ hence it is the government’s responsibility to ensure access to education for everyone, especially those from poor households, who cannot afford the high fees of private schools.

Chapter 5.2: Determinants of public education expenditure: Evidence from Indian states

Background

As discussed previously, the past Indian literature on the relationship between public education expenditure and economic growth is largely inconclusive, as far as the growth enhancing effect of education expenditure is concerned. The econometric analysis conducted in Chapter 5.1 indicates that the education expenditure by the Indian government has indeed affected India's growth performance positively. From a policy perspective, such results establish that education expenditure is a crucial determinant of growth and the immediate policy recommendation then would be to advocate an increase in the spending from its current level of around 3% of GDP. For this increase in education budget to materialise, it would be crucial to identify the factors that determine education expenditure in India. This is because expenditure in the education sector varies significantly across Indian states with some states spending significantly more than the others.

5.2.1 Introduction

After independence, the Constitution of India recognised education as a state subject. Though it was transferred to concurrent list (i.e. concurrent with the central government or centre) in 1976, yet the main responsibility of financing education still rested on the state governments.

Table 5.15: Share of Centre's and States' Expenditure in Total Public Expenditure on Education

Year	Share of States	Share of Centre
1990	88.3	11.7
1995	85.7	14.3
2000	87.3	12.7
2005	81.1	18.9
2010	77.8	22.2

Source: Analysis of Budgeted Expenditure on Education (Various Issues), Ministry of Human Resource Development, Government of India.
Note: Includes both Plan and Nonplan expenditure[52]

However, there is a lot of disparity within states in terms of expenditure on education by the respective state governments. In Table 5.16, I rank the 16 Indian states used in the econometric analysis according to their respective per capita public education expenditure (Column 3) and Net State Domestic Product (NSDP) per capita (Column 5) in 2010. Hypothetically speaking, I would expect that richer states spend more on education compared to the poorer states. Overall, the rankings achieved by the states conform to that belief. High-income states such as Haryana, Kerala and Maharashtra have some of the highest investments in education in India. But, there are exceptions too. Assam, despite being a low-income state (ranked 13th out of the 16 states) ranks very high in terms of education spending. Himachal Pradesh ranks 1st in terms of per capita spending but does not come even among the richest five states.[53] Some of the richest states like Tamil Nadu and Gujarat register a mediocre performance when it comes to state spending on education.

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[52] Plan expenditure is that part of the total budgeted expenditure which is meant for financing various education schemes and programmes proposed under Five year plans. It indicates the direction of changes in the education sector. Nonplan expenditure is the expenditure on operating and maintaining existing education infrastructure.
The central government, over time, came to play an increasingly dominant role in shaping the country's education system. This led to a steady rise in the central government's Plan expenditure share, from around 40% in the early 1990s to around 63% in 2003. This, in turn, explains the increase in its share in total public education expenditure from 18.9% in 2005 to 22.2% in 2010. The state governments are primarily concerned with the Nonplan expenditure in the education sector which implies that it is the policies of the centre which shapes India's education system. See De and Endow (2008) for more details.

[53] It is possible that Assam and Himachal are exceptions because of their size and it is easy for these states to spend more than the larger states because of their low population. Himachal Pradesh is the least populated state (ranked 16th) among all the 16 states included in the study and Assam is ranked 13th (Census of India, 2011).

Table 5.16: Ranking the States by Per Capita Public Education Expenditure and NSDP per capita in 2010-11

State	Per Capita Public Education Expenditure (INR)	Rank	Real NSDP per capita (INR)	Rank
Top five states in terms of education expenditure (Ranks 1-5)				
Himachal Pradesh	2314.4	1	36327.66	6
Haryana	1543.6	2	49945.90	1
Maharashtra	1479.2	3	39602.34	4
Assam	1404.9	4	18734.02	13
Kerala	1163.3	5	41203.87	2
Middle Ranked States (Ranks 6-11)				
Karnataka	1097.5	6	29279.9	9
Punjab	1056.6	7	36287.7	7
Tamil Nadu	1048.3	8	36417.6	5
Orissa	1047.9	9	18935.4	12
Gujarat	1015.3	10	40244.1	3
Rajasthan	984.4	11	23304.3	11
Bottom five states (Ranks 12-16)				
West Bengal	929.4	12	28486.34	10
Andhra Pradesh	896.4	13	30719.32	8
Uttar Pradesh	723.6	14	15501.40	15
Bihar	625.9	15	12068.39	16
Madhya Pradesh	621.4	16	16739.98	14
Spearman's rank correlation coefficient= 0.66				

Source: Author's own calculations based on data from State Finances (Various Issues), Reserve Bank of India.
Note: Assigned ranking is based on the performance of the sixteen states included in the sample. NSDP per capita is at 1999 constant prices and per capita public education expenditure is at 2001 constant prices.

Over the span of a decade (2001-2010), the ranking of the states on the basis of education expenditure have not changed substantially; the only exception being Haryana which jumps from the 8th position in 2001 to 2nd position in 2010 (see Table 5.17). However, Haryana was also the richest Indian state in 2010. Among the low-income states, only Orissa (with a NSDP per capita only higher than Bihar, Uttar Pradesh and Madhya Pradesh in 2010) does slightly better to move up from the worst performers' group into the middle category (ranks 6th-11th). The worst performing states of West Bengal, Bihar, Uttar Pradesh and Madhya Pradesh continued to remain at the bottom of the ranks.

Table 5.17: Ranking of states by Per capita Education Expenditure in 2001 and 2010

State	Edurank_2001	Edurank_2010
Himachal Pradesh	1	1
Assam	2	4
Kerala	3	5
Punjab	4	7
Maharashtra	5	3
Tamil Nadu	6	8
Gujarat	7	10
Haryana	8	2
Karnataka	9	6
Rajasthan	10	11
Andhra Pradesh	11	13
West Bengal	12	12
Orissa	13	9
Uttar Pradesh	14	14
Bihar	15	15
Madhya Pradesh	16	16

Note: Author's own calculations based on data from State Finances (Various Issues), Reserve Bank of India. EDURANK refers to ranking assigned on the basis of education expenditure per head by the state governments.

So, in this section, I ask: what are the factors that determine the level of education expenditure by state governments? The rest of the paper is structured as follows. Section 5.2.2 reviews the relevant literature. Section 5.2.3 discusses the econometric models used in the study and Section 5.2.4 presents and interprets the results. Section 5.2.5 concludes.

5.2.2 Overview of the literature

A review of the existing literature reveals that determinants of public education expenditure go beyond the economic factors; demographic and political determinants too play a significant role.

5.2.2.2 Economic Factors

The public expenditure-economic growth link was first postulated by the German political economist Adolf Wagner (Lamartina and Zaghini, 2010)**.** Wagner's Law (also known as the law of increasing state spending) states that the growth in real income would lead to an increase in public welfare expenditure (which includes education expenditure). Wagner hypothesises that demand for services by the citizens is income-elastic and hence, as economic conditions improve, the demand for social and cultural goods also rises. Economic factors are also important because they represent some of the budget constraints that a government faces while allocating resources.

The positive effect of economic factors on public education expenditure in India is well-documented in the previous studies. Using panel data for 15 Indian states from 1992-93 to 1997-98, Roy et al. (2000) attempts to estimate the determinants of public expenditure on primary, secondary and higher education. The paper finds that rich states spend more on education compared to poorer states. Chakrabarti and Joglekar (2006) explore the government financing of education over a span of 1980-81 to 1999-2000 across 15 major states of India and found that states with higher per capita income spent more on education.[54]

5.2.2.3 Demographic Factors

The effect of demographic characteristics on education expenditure is slightly ambiguous.[55] Mehrotra (2004), in India’s context, states that even if some backward states attach high priority to education, larger number of school-going children probably reduces their per capita spending on education. However, it can also be the case that a state with a larger child population is spending more on education than a state with ageing population because the former has the incentive to reap the benefits of a potential demographic dividend.

The international literature on the issues of demographic characteristics and public education expenditure can be broadly categorised into two groups. One group of papers analyse the

[54] Chhibber and Nooruddin (2004) report a similar relationship between per capita state income and developmental expenditure for Indian states.

[55] See Cutler et al. (1993) for a detailed discussion on the theoretical relationship between demographic characteristics and public spending.

potential competition between the elderly and younger segments of the population for public resources. The other group examines the link between size of the young population and education finance (Grob and Wolter, 2005).

Intergenerational Conflict in the context of Public Education Expenditure

It is generally assumed that an individual's preference for a public service is determined by whether that person is likely to be a direct user of the service. This implies that different groups of voters compete for shares of the public budget and a rising share of elderly voters in the population should hypothetically lead to a fall in public education expenditure. That is because the needs of elderly people differ from that of the younger population and, consequently, the former will prefer higher investments in areas (other than education) which benefit them directly.

The international evidence is quite mixed on this issue. Using panel data for the states of the United States for 1960–1990, Poterba (1997) finds that an increase in the share of elderly residents in a jurisdiction is associated with a significant reduction in per-child educational spending. Harris et al. (2001) also find that a growing share of elderly at the state level tends to depress state spending on education in United States. Many European studies such as Borge and Rattsø (1995), Grob and Wolter (2005) and Borge and Rattsø (2008) report similar negative relationship for Norway, Switzerland and Denmark respectively. On the other hand, there are studies which refute this claim. Strömberg (1998) argues that altruism can reduce intergenerational conflicts. Duncombe et al. (2003) say that majority of studies on this issue have used aggregate data that do not provide specific evidence on preferences of elderly people, and assume that all elders are similar in their views. They find that elderly with grandchildren are more likely to support school spending than those without.

Size of Young Population and Public Education Expenditure

Most empirical studies find that it is a disadvantage to be part of a large cohort. This is understandable since cost of providing education increases with the increase in student population. The government has to spend more on building schools, employ additional teachers and give more aid. Using data on 48 US states from 1960-2000, She (2004) finds that percentage of young population (aged 5 to 17 years) has a negative impact on education spending. This finding is consistent with other major studies on US in this field such as Porterba (1997) and Fernandez and Rogerson (1997). This finding gets support in many European studies as well. Heinesen (2004) finds a negative relationship between young population and public education spending for Denmark. Using a panel data model for 1989-1996, Borge and Rattsø (2008) show that education spending per child (7-15 years) is negatively correlated with the size of the population of that age group. Kempkes and Seitz (2005) report similar findings for western German states.

5.2.2.4 Political factors

Political factors are also regarded as important determinants of public spending on education. Many past studies show that factors such as the political ideology of the ruling party determine the level of government intervention in the economy and thus influence government decisions regarding expenditure on development (Hibbs, 1977; Alesina, 1987; Boix, 1998).[56] Besides political ideology, corruption can be another crucial determinant. Corruption affects the public provision of social services such as health and education (Gupta et al., 2000). The more the corruption in a particular state, the more the government in that state will be potentially inclined to spend in sectors such as infrastructure projects where corruption opportunities are abundant, rather than on education where the opportunities are much more limited (Shleifer and Vishny, 1993; Mauro, 1998).

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[56]Boix (1998), for example, says that while social democrats and conservatives both seek growth, each adopts different policies. The “left” uses public investment in human and physical capital to achieve growth while the “right” reduces taxes and government involvement in the economy to boost private sector involvement for growth.

Hence, I control for economic, demographic and political variables while assessing the determining factors for public education spending in Indian states. The econometric model used in the paper has been explained in the following section.

5.2.3 Model Specification and Variable Description

I conduct the analysis using data on 16 Indian states from 2001-2010. Other states could not be included because of data limitations. However, it should be noted that my sample includes all the major states of India and covers about 91% of the total population.

Per capita state expenditure on education has been used as the dependent variable in our model. I do not work with the absolute value of the education expenditure in order to control for the state size. For example, larger states like Uttar Pradesh and Madhya Pradesh spend more on education compared to smaller states such as Kerala and Himachal Pradesh in absolute terms. However, the picture is quite the opposite if we look at the per capita expenditure which, I believe, is a more effective indicator than aggregate values (see Table 5.16).

The initial econometric model used in this paper looks as follows:

$$LEDEXPpc_{it}=\beta_0+\beta_1 LEDEXPpc_{it-1}+\beta_2 LNSDPpc_{it}+\beta_3 LTAXpc_{it}+\beta_4 LGRANTpc_{it}+$$

$$\beta 5LOANpc_{it}+\beta_6 RIGHT_{it}+\beta_7 LEFT_{it}+\beta_6 REGIONAL_{it}+\beta_7 TREND+e_{it} \qquad (1)$$

where, in state i and year t,

'EDEXPpc' is education expenditure per capita by state government (2001 constant prices), 'NSDPpc' is Net State Domestic Product per capita at 1999-2000 constant prices, 'TAXpc' is state's own tax revenue per capita (2001 constant prices), 'GRANTpc' and 'LOANpc' are respectively grants per capita and loans per capita received from central government (2001 constant prices).[57]We initially used ‘Ideological competition’ as the political control in our model. Our classification of parties along the line of ideology is broadly based on Chhibber and Nooruddin (2004). The Indian National Congress (INC) party has been classified as a ‘CENTRIST’ party. Any state ruled by the communist parties or Bharatiya Janata Party (BJP) has been coded as ‘LEFT’ or ‘RIGHT’ respectively. A state ruled by any of the regional parties is coded as ‘Regional’. Classification of the states in this manner enables us to see the comparative impact of the different types of ideological competition on the public expenditure on education. The “Ideological Competition” enters our model as dummy variables called ‘CENTRIST’, ‘LEFT’, ‘RIGHT’ and ‘REGIONAL’ where ‘CENTRIST’ is the control category which takes the value of 1 if the Congress party is in power and 0 otherwise. Similarly, the other dummy variables can be defined.

A ‘CENTRIST’ or a ‘LEFT’ party can be hypothetically expected to invest more in education (more pro-poor policies and hence higher expenditure on social sectors) compared to a ‘RIGHT’ party. Also, since independence, Congress has been in the power for most of the time so it may be expected that when the other parties (BJP, left parties and regional parties) come to power they may want to expand their influence over the state bureaucracy. Such behaviour then should possibly lead to allocation of more funds towards administration, in turn, lowering developmental expenditure (Chhibber and Nooruddin, 2004). Hence, given Congress or ‘CENTRIST’ is the control category, we expect the coefficients on ‘RIGHT’, ‘LEFT’ and ‘Regional’ to be negative. We also include a time trend (‘TREND’) in our model.

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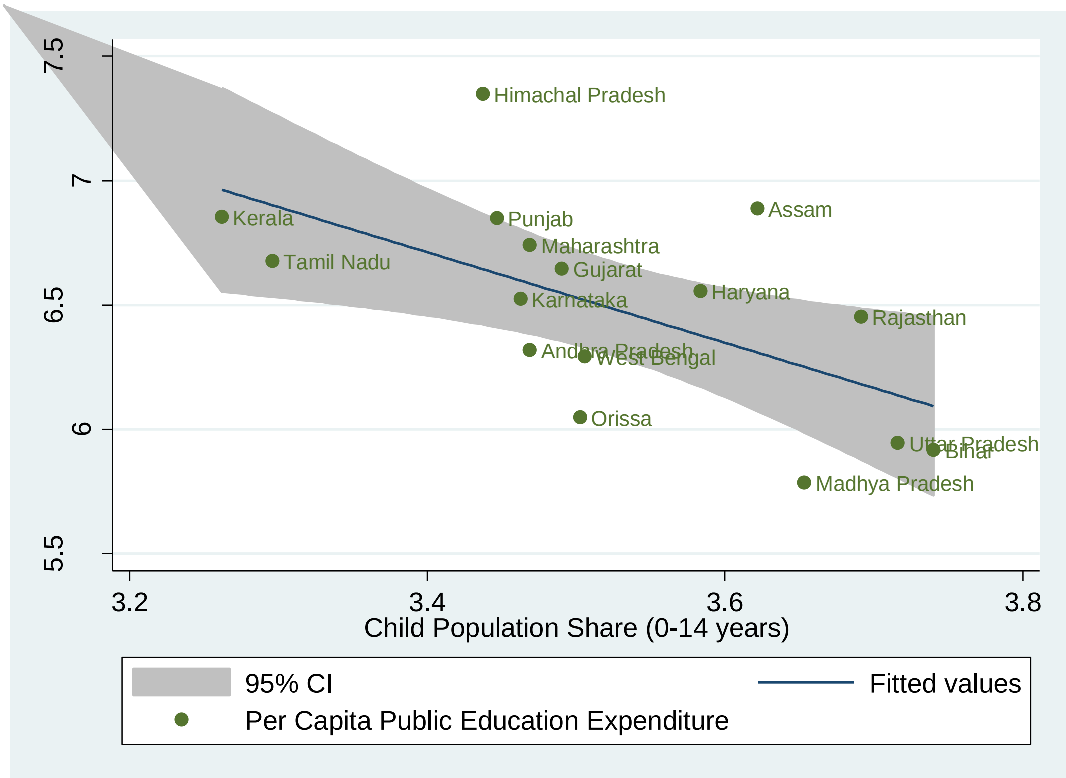
[57]‘LOANpc’ can also be regarded as a political variable because loans are often negotiated politically between Centre and state and repayment is sometimes waived. The variable is defined as gross loans from Centre minus repayment of loans to the Centre.
See Table 7 in the Appendix for data sources.

All the economic variables are expressed in their natural logarithms apart from 'LOANpc' since this variable takes the value of zero for some states in some years. So we kept the variable in levels to avoid losing observations. The estimation results of Equation 1 are reported in Table 5.19.

I also wanted to use child population share (defined as % of total population below 14 years) as a control for the demographic features of a state in Equation 1. But this variable could not be included because data is not available for all years (Population Census is conducted every ten years in India). However, a scatterplot analysis reveals that there might be a negative correlation between child population and per capita education spending in India.

Figure 5.2: Child Population and Per Capita Public Education Expenditure Scatterplot



Note: Author's own calculations. Per capita public education expenditure is the Y variable and percentage of population below 14 years of age is the X variable. Both variables are expressed in their natural logarithm. The year is 2001.

States which spend the least on education such as Bihar, Uttar Pradesh and Madhya Pradesh are also among the most populous states. The high-performing states such as Kerala, Himachal Pradesh and Punjab have some of the lowest child population shares in the sample.

Table 5.18: Ranking the States by Child Population and Per Capita Public Education Expenditure (EDEXPpc) in 2001-02

State	Child Population	Poprank	EDEXPpc	Edurank
Bihar	42.1	1	371.2	15
Uttar Pradesh	41.1	2	381.9	14
Rajasthan	40.1	3	634.3	10
Madhya Pradesh	38.6	4	325.7	16
Assam	37.4	5	981	2
Haryana	36	6	702.7	8
West Bengal	33.3	7	541.2	12
Orissa	33.2	8	424.2	13
Gujarat	32.8	9	770.2	7
Andhra Pradesh	32.1	10	554.9	11
Maharashtra	32.1	10	846.6	5
Karnataka	31.9	11	681.8	9
Punjab	31.4	12	943.2	4
Himachal Pradesh	31.1	13	1554.4	1
Tamil Nadu	27	14	794.4	6
Kerala	26.1	15	948.9	3

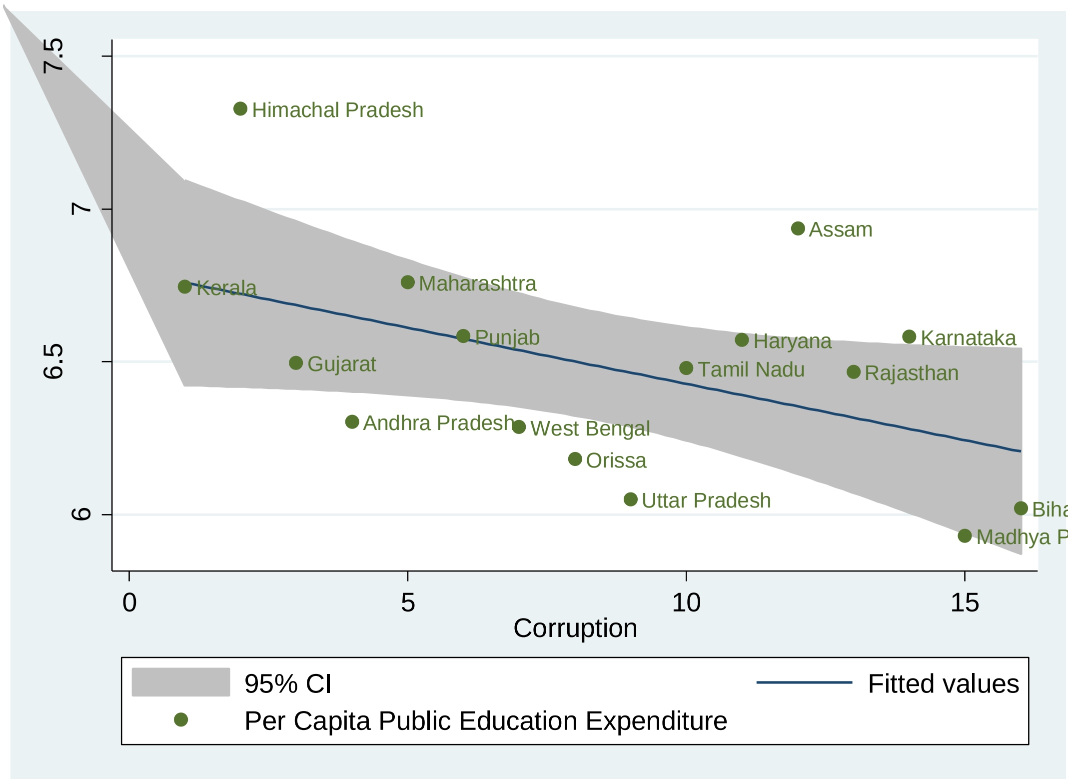
Note: Data on Child Population is obtained from Census of India, 2001. Poprank and Edurank refer to the ranks assigned to states according to the size of child population and per capita public education on expenditure respectively. A lower rank means a larger child population.

However, based on these one year statistics, we cannot comment on causality. Similar problems occurred when I tried to include ‘corruption’ as a political or institutional control in our econometric model. To my knowledge, the only available corruption index for Indian states was constructed by Transparency International for the year 2005.[58]I still wanted to include this variable in my analysis because corruption is a significant problem in India and

[58]The study, covering a total of 14,405 respondents from 20 Indian states, aimed to capture the level of “petty corruption” that the common man faced in obtaining 11 different public services such as Education (up to 12th Std.), Police, Land Records & Registration, Electricity, Water Supply, Government Hospitals, Income Tax, Public Distribution System, Judiciary, Municipal Services and Rural Financial Institutions. The indices were constructed using both the perception of corruption and actual experiences of paying bribes for obtaining public services. The respondent’s perceptions and experiences of corruption were assigned weights of 40 and 60% respectively. See Table A5.5 in Appendix for the ranking of Indian states by this study.

its level varies significantly from state to state.[59] For example, states such as Bihar and Madhya Pradesh are amongst the most corrupt states. Conversely, Kerala and Himachal Pradesh, who spend the highest on education, are the least corrupt states (see Figure 5.3).

Figure 5.3: Corruption and Per Capita Public Education Expenditure Scatterplot



Note: The X variable, 'Corruption', stands for the Corruption Index constructed by the TI-CMS Indian Corruption Study (2005) for Indian states. Per capita public education expenditure has been expressed in natural logs. The year is 2005. Some state ranks in the graph may not match with the TI-CMS ranking. This is because the TI-CMS study works with 20 states but I have 16 of them in our sample. Accordingly, I modified the ranks keeping the relative positions of states fixed.

The only way that demographic characteristics and corruption could be included in my econometric model is by assuming that these are time invariant variables. This assumption will not be so unrealistic in the context of this analysis since the time period is just ten years. That is because factors such as demographic characteristics and level of corruption take time to change significantly and hence it could be safely assumed that the relative ranking of the Indian states on the basis on these two criteria will stay more or less the same over a span of a

[59] In 2012, India was ranked at 94th position out of 176 countries (Corruption Perception Index 2012, Transparency International).

decade (ten years). However, with such time invariant variables in the model, the fixed effects method becomes ineffective. The random effects model also could not be used because it assumes that the individual (or, time invariant) effects are uncorrelated with other explanatory variables. If that assumption is not met, the estimator becomes inconsistent. An alternative approach is to add the group means of the independent variables (which vary within groups) to the model. This technique was proposed by Mundlak (1978) as a way to relax the aforesaid assumption in the random-effects estimator.

In a general form, a random effects model can be written as

$$y_{it}=\alpha_t+\beta x_{it}+c_i+u_{it} \qquad (2)$$

where, x_{it} is the explanatory variable, c_i is the time-invariant individual effect and u_{it} is the error term. A random effects estimation requires $Cov(c_i, x_{it}) = 0$ which is unlikely in our case since there is high probability that corruption level will be correlated with variables like state income. According to Mundlak (1978), if $Cov(u_{it}, x_{it}) \neq 0$ then

$$c_i= \Omega + \delta\bar{x}_i+ a_i \qquad (3)$$

where, $\bar{x}_i$= group mean of the explanatory variable.

Plugging (3) into (2), we get

$$y_{it}= \alpha_t+\beta x_{it}+ \delta\bar{x}_i+a_i+u_{it} \qquad (4)$$

where, Ω gets absorbed into the time intercepts.

So, I re-estimate the model using this approach in order to include controls for demography and corruption. My final model is expressed as follows.[60]

[60]I do find any evidence that political ideology of the ruling party influences education spending by state governments (see results in the next section) and consequently drop it from the final model, Equation 5.

$$LEDEXPpc_{it} = \beta_0 + \beta_1 LNSDPpc_{it} + \beta_2 LTAXpc_{it} + \beta_3 LGRANTpc_{it} + \beta_4 LOANpc_{it} + \beta_5 Mean\_LNSDPpc_i + \beta_6 Mean\_LTAXpc_i + \beta_7 Mean\_LGRANTpc_i + \beta_8 Mean\_LOANpc_i + \beta_9 LPOP_i + \beta_{10} CORRUPTION_i + e_{it} \quad (5)$$

where, 'LPOP' and 'CORRUPTION' stand for child population share (0 to 14 years) and TI-CMS Corruption Index for Indian states respectively.

5.2.4 Results and Discussion

5.2.4.1 Initial Model Estimation (Equation 1)

I start by checking whether Random Effects model (REM) or Fixed Effects model (FEM) should be used. The Hausman test ruled in favour of the FEM. But the problem of first order autocorrelation was detected in the FEM estimation results so I do not draw any inference from our FEM results and instead re-estimate the model using Feasible Generalized Least Squares (FGLS) method. FGLS method allows estimation in the presence of first-order autocorrelation within panels, heteroskedasticity or cross-sectional correlation across panels. However, there can be potential reverse causality bias in the FGLS results if there is a causality running from state education expenditure towards economic growth. In that case, NSDPpc will not be exogenous anymore and the results obtained will not be reliable for drawing any inference. So, I also estimate an Instrumental Variable Regression using two-stage least squares (2SLS) method to control for the potential reverse causality. The econometric results are presented below.

Table 5.19: Panel Model Estimation Results: 2001-2010

Independent Variable	Fixed Effects Model (I)	Feasible GLS Regression (II)	IV(2SLS) Regression (III)	IV(2SLS) Regression (IV)
LEDEXPpc(-1)	0.17***	0.35***	0.35***	0.37***
LNSDPpc	0.28	0.34***	0.91**	0.93***
LTAXpc	0.07	0.03	-0.21	-0.13
LGRANTpc	0.08	0.21***	0.06	0.07
LOANpc	0.00**	0.00	0.00*	0.00*
RIGHT	0.02	-0.02	-0.02	
LEFT	-0.13***	-.02	-0.12	
REGIONAL	-0.02	0.00	0.01	
TREND	0.03*	0.01	0.01	
CONSTANT	1.43	-0.78**		
	Hausman Test H_0:REM preferred P-value=0.00 **Woolridge Test for Autocorrelation** H_0: No first-order autocorrelation P-value=0.01 **Pesaran's Test of cross-sectional independence** H_0:No cross-sectional dependence P-value=0.30		LSDPpc is instrumented using own 1st and 2ndyear lagged values. **Underidentification test** H_0: Model is underidentified P-value=0.00 **Hansen's J test** H_0:Instruments are valid P-value=0.13	**Joint Test of Significance (from III)** H_0: RIGHT=0 LEFT=0 REGIONAL=0 P-value=0.57 **Underidentification test** H_0:Model is underidentified P-value=0.00 **Hansen's J test** H_0: Instruments are valid P-value=0.12

Note: Dependent Variable: Education Expenditure per capita by the state government.
Number of observations is 159 in FEM and FGLS estimation and 128 in IV estimation.
A trend variable has been included in the model. Heteroskedasticity-robust standard errors are used for FEM and IV estimation. According to Variance Inflation Factor (VIF) estimates, our model does not suffer from the multicollinearity problem.
***, ** and * represent statistical significance at 1%, 5% and 10% level respectively.

Education expenditure by the state governments increases with an increase in state income (NSDPpc).Loans from centre also come out to be a statistically significant determinant of education expenditure however the effect seems to be negligible. The effect of political ideology seems to be fragile in expenditure decisions which are consistent with Chhibber and Nooruddin (2004) who also try to assess whether political ideologies matter in the context of spending decisions by state governments in India. We find some evidence that "LEFT" parties-led state governments spend less than Congress-led state governments on education but the result is sensitive to different estimation methods. The political ideology variables jointly also came out to be statistically insignificant in IV estimation and were consequently dropped from the final model (see Equation 5).

A major drawback of these methods (FEM, FGLS and IV 2SLS) is that we could not include controls for demographic characteristics and corruption in our model. Therefore, we refrain from deriving any conclusion from the results presented in Table 5.19 since there is ample international evidence, as discussed in the previous section, that factors such as demographic characteristics play a significant role in determining public spending.

5.2.4.2 Final Model Estimation (Mundlak's Approach)

I incorporate child population share and TI-CMS corruption index as proxies for demography and corruption respectively in my model and re-estimate it using Mundlak's approach (see Equation 5 above).[61]

[61]See Table A5.6 in the Appendix where I re-run the Mundlak model using elderly population share as an alternate proxy for demographic characteristics. In case of Indian states, elderly population share does not exert any influence on public education expenditure.

Table 5.20: Final Model Estimation Results: Mundlak's Approach

Independent Variable	Coefficient
LNSDPpc	0.50***
LTAXpc	0.31**
LGRANTpc	0.11**
LOANpc	0.00***
Mean_LNSDPpc	-0.28
Mean_LTAXpc	-0.00
Mean_LGRANTpc	0.23***
Mean_LOANpc	-0.00***
LPOP	-0.76*
CORRUPTION	0.00
CONSTANT	2.82
Joint Test of Significance H_0: LMNSDPpc, LMTAXpc, LMGRANTpc and LMLOANpc are jointly equal to 0 P-value=0.00	

Note: Dependent Variable: Education Expenditure per capita by the state government. LPOP and CORRUPTION are the time invariant variables. ***, ** and * represent statistical significance at 1%, 5% and 10% level respectively.

The finding, NSDP per capita is a significant determinant of public education expenditure, is robust to different model specifications and estimation methods. Quantitatively speaking, 1% rise in the NSDP per capita leads to around 0.5% increase in per capita education spending. Other economic variables such as tax revenue and grants received from centre also increase spending on education significantly. If per capita tax revenue and per capita grants rise by 1% we would expect education spending to rise by 0.31% and 0.11% respectively in response. The coefficient on loans from centre also comes out to be statistically significant however its size is very small (0.00). There is a negative association between per capita education expenditure and share of child population. If child population share goes up by 1% then we may expect that per capita spending will go down by around 0.76%. This probably suggests that a larger share of children (0 to14 years) in total population is one of the reasons why states like Bihar, Uttar Pradesh, Madhya Pradesh and Rajasthan spend less on education compared to the rest of the Indian states. As we saw earlier in Table 5.16, these states are lagging behind most of the other states in terms of economic growth too. Based on these findings, it can probably be asserted that the future of India's demographic dividend looks dim. That is because the population of the rich states are slowly aging and the fastest growth in the working age population is going to take place in Uttar Pradesh, Bihar and Madhya Pradesh after Haryana over the next two decades. Uttar Pradesh, Bihar and Madhya Pradesh will have roughly one-third (around 31.3%) of India's working population in 2026 (Thakur, 2012).[62] Further investment in education is needed in these states to reap the benefits of this growing working age population.[63] This, in turn, will translate into higher human capital stock and ensure faster economic growth in future.

Corruption does not seem to affect education expenditure in Indian states. We tried to use administrative expenditure and expenditure on wage and salaries by state governments (each measured as percentage of total state expenditure) as alternate proxies for corruption because it can be presumed that more the corrupt a government, more will be its expenditure on unproductive investments. However, none of these two expenditure shares seem to have a statistically significant impact on public expenditure on education and were consequently dropped from the model. [64]

5.2.5 Conclusion

This section tries to identify the determinants of education expenditure in 16 Indian states for the time period 2001-2010 using panel model analysis. The econometric findings indicate that richer states spend more compared to the poorer ones. Other economic variables such as

[62] See Table A5.4 in the Appendix.

[63] Kumar (2010) also highlights this issue.

[64] I also wanted to use income inequality as a proxy for corruption. For a detailed discussion on how income inequality can lead to corruption in democratic states, see You and Khagram (2004). But Charron (2010) does not find inequality to be a significant determinant of corruption in Indian states. So, I do not include this variable in my study.

tax revenue and grants from the central government also exert a positive impact on education expenditure.

We do not find any evidence that political ideology of the ruling party affects education spending decisions in Indian states. The paper also considers other political factors like corruption which can be hypothetically expected to lower public welfare spending in areas such as education. A scatterplot analysis reveals a weak correlation between education spending and corruption. Bihar and Madhya Pradesh, who spend the lowest on education, are also among the most corrupt states. Conversely, the high performers like Kerala and Himachal Pradesh are the least corrupt states. However, the econometric analysis does not find evidence in support of this correlation.

There is a negative association between child population share (0-14 years, as percentage of total population) and education expenditure. The states with the largest share of child population in India are Madhya Pradesh, Bihar and Uttar Pradesh. These are also the poorest states in India with the most underinvested education sectors in the country. Over the next two decades, these states will experience the fastest growth in the working age population among all the Indian states. Given this scenario, it can be argued that the future prospects of India's Demographic Dividend look dim. The governments in those states need to implement widespread reforms in the education sector to reap the benefits of this growing youth population.

One may argue that, in India's case, there is ample empirical evidence that private schools are more efficient than public schools in imparting learning (Desai et al., 2008; French and Kingdon, 2010; Pal and Kingdon, 2010). Hence the expected policy implication should be to let more private schools to be opened, instead of focusing on education expenditure by state governments. However, private schools charge a fee which families from poor economic backgrounds struggle to pay. Private schools, just like any other private enterprise, operate for profits and so it is unlikely that such schools will open in poor and backward areas of the country. It is not unusual when Pal (2010) finds that private schools are more likely to be present in villages with better off households and better infrastructural facilities. In a developing country like India, where, in 2010, 32.7% of the population was still below the poverty line[65] (World Development Indicators, 2012) and 26% of the children of lower secondary school age could not attend school (UNESCO Institute for Statistics, 2010) it is the government which has to ensure access to education for all. This will also help achieve "universal elementary education" (one of the Millennium Development Goals, MDGs) and ensure more inclusive growth in the long run.

Finally, I acknowledge the fact that increasing education expenditure per se will not guarantee an increase in human capital stock and a higher economic growth rate. The quality of education is equally important, which has to be ensured by providing sufficient number of qualified teachers in public schools, teaching aids, sufficient textbooks (with other learning aids) and other necessary amenities. But even to ensure good quality, raising the level of public expenditure in education is absolutely essential (Ghosh, 2011).

[65] Here, poverty line is defined as $1.25 a day as per the World Bank definition.

Appendix 5

Table A5.1: Data Source

Variable	Source
GDP	Handbook of Statistics on Indian Economy 2012 published by Reserve Bank of India. Accessed at: http://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook+of+Statistics+on+Indian+Economy
Primary, Secondary and Tertiary Education Expenditure	Union Budget(various issues) of Government of India. Accessed at http://indiabudget.nic.in/ Ministry of Human Resource Development, Government of India. Accessed at http://mhrd.gov.in
Trade	World Development Indicators, 2012
PCapital	Handbook of Statistics on Indian Economy 2012
Labour	Handbook of Statistics on Indian Economy 2012

Table A5.2:ADF test Results with trend and intercept

Variable	Level	First Difference
LGDP	0.99	0.00***
LPrimary	0.46	0.00***
LSecondary	0.07	0.00***
LTertiary	0.54	0.00***
LTrade	0.48	0.00***
PCapital	0.46	0.00***
LLabour	0.41	0.00***

Figure A5.2: Impulse Response Graph from VAR Estimation in Table 5.2

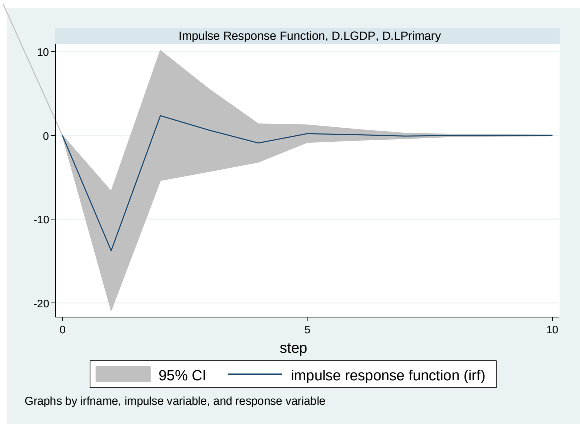
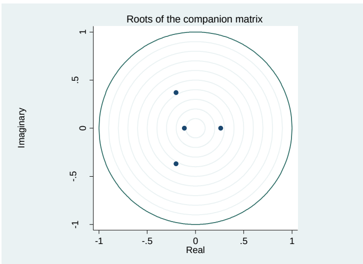
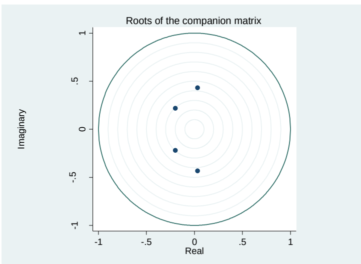


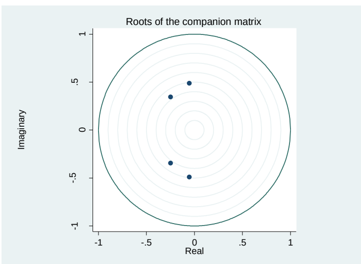
Figure A5.3: Unit Root Circles



(a)

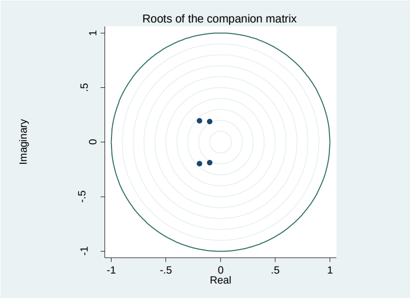


(b)

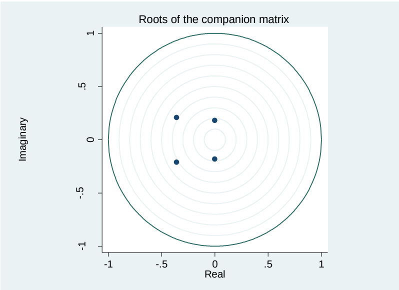


(c)

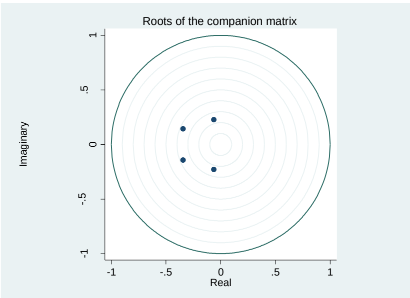
Figure A5.3: Unit Root Circles for the Fully Specified Model



(a)



(b)



(c)

<u>State list</u>

Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal

Table A5.3: Data Source

Variable	Source
Education expenditure by state governments	Reserve Bank of India (RBI) database
Net State Domestic Product	Reserve Bank of India (RBI) database
Grants and Loans from Centre	Reserve Bank of India (RBI) database
State’s Tax Revenue	RBI publications, various issues
‘Political Ideology’ variables	Election Commission of India website
Demographic Variables	Census of India, 2001 and 2011
Corruption Index	India Corruption Study 2005, Transparency International India

Table A5.4: Distribution of India’s Working Age Population (WAP) in 2026

State	Share of WAPas % of India's total WAP population
Uttar Pradesh	16.95
Bihar	8.11
Madhya Pradesh	6.22
Haryana	2.31
Himachal Pradesh	0.55
Maharashtra	9.74
Kerala	2.60

Source: Thakur (2012).

Note: Choice of states based on our ranking of states in terms of per capita education spending by state governments. No data is available for Assam.

Table A5.5: Ranking of States on Corruption

State	Rank
Kerala	1
Himachal Pradesh	2
Gujarat	3
Andhra Pradesh	4
Maharashtra	5
Chhattisgarh	6
Punjab	7
West Bengal	8
Orissa	9
Uttar Pradesh	10
Delhi	11
Tamil Nadu	12
Haryana	13
Jharkhand	14
Assam	15
Rajasthan	16
Karnataka	17
Madhya Pradesh	18
Jammu & Kashmir	19
Bihar	20

Source: TI-CMS Indian Corruption Study (2005).
Note: Higher rank denotes lower corruption and vice versa.

Table A5.6: Mundlak Model Results with Elderly Population as proxy for demographic structure

Independent Variable	**Coefficient**
LNSDPpc	0.50**
LTAXpc	0.31**
LGRANTpc	0.11**
LOANpc	0.00***
Mean_LNSDPpc	-0.18
Mean_LTAXpc	-0.07
Mean_LGRANTpc	0.23***
Mean_LOANpc	-0.00***
LELDERLY	0.43
CORRUPTION	0.00
CONSTANT	-1.22
Joint Test of Significance H_0: LMNSDPpc, LMTAXpc, LMGRANTpc and LMLOANpc are jointly equal to 0 P-value=0.00	

Note: LELDERLY= Fraction of elderly population (aged above 60 years) in total population expressed in natural logarithm.Dependent Variable: Education Expenditure per capita by the state government.LELDERLY and CORRUPTION are the time invariant variables. ***, ** and * represent statistical significance at 1%, 5% and 10% level respectively.

Chapter 6: Conclusion

6.1 Summary of the thesis

In this thesis, I address some of the widely debated issues in the empirical education and trade literature in the context of India. The introductory chapter (Chapter 1) presents the motivation behind this work. To test the empirical relationship between public education expenditure, trade openness and economic growth of India, I have used data at different levels such as aggregate, sectoral and state levels. Consequently, I have used various econometric methods depending on the nature of the data to test my hypotheses. Furthermore, trade openness is a multi-dimensional concept and I have used varied measures as proxy for this variable. Chapter 2 discusses the research questions analysed in each chapter and the rationale behind the use of different methods and measurements. Chapter 3 examines the impact of public education expenditure and trade openness on the economic growth of India using time series econometric methods. Chapter 4 investigates for the trade-growth nexus further by using disaggregated level (sectoral and state level) data. Firstly, I disaggregate the overall GDP by agriculture, manufacturing and services sectors and then try to assess which sector benefitted most from trade openness. Secondly, I examine the trade-manufacturing growth nexus at the Indian state level. Chapter 5involves analysis of the growth effects and determinants of public education expenditure employing disaggregated level examination. Firstly, I disaggregate the public education expenditure data by primary, secondary and tertiary sectors and examine the nature of the relationship between each sectoral expenditure and growth for the time period 1951-2011. Secondly, I try to find the determinants of public education expenditure in India at the state level using panel data for 16 major Indian states for the time period 2000-2010.

6.2 Key Findings

6.2.1 Public Education Expenditure and Growth

The assessment of the empirical relationship between public education expenditure and economic growth of India in Chapter 3 shows that the former has an overall positive impact on the country's GDP growth. However, the effect is fragile and sensitive to different estimation methods. I argue that one of the main reasons behind the lack of robustness can be attributed to the fact that the nature of this relationship varies across sectors and thus aggregate level analysis produces inconsistent estimates. Furthermore, I find that the nature of the relationship between each sectoral expenditure and growth changes over time. Thus, estimating the relationship without taking the parameter change into consideration also leads to inaccurate findings. The findings from Chapter 5 conform to these arguments. None of the sectoral education expenditure had any impact on growth when the analysis is carried out for the entire time period 1951-2011. The expenditure started to exert a positive impact on Indian GDP growth once the country embraced substantial industrial reforms since 1980s, started to encourage private sector participation and eventually embraced globalisation in 1991-92. As a result, industrial and service sectors expanded creating more job opportunities and thus there was better utilisation of the educated labour pool. Prior to the 1980s, policy regulations in the Indian economy gave ample opportunities for rent-seeking, especially for large enterprises. Moreover, because of the rigid labour laws it was not easy to fire employees, especially in the public sector. Hence there was a tendency among the companies to hire fewer employees on long term contracts. As a result, the unemployment among graduates in India was quite high, thereby underutilising the available human capital. Bureaucratic jobs in the public sector were the most attractive form of jobs which are highly unproductive and encourage rent-seeking. That is why, probably, education expenditure did not have any effect on growth during 1951-1979 and this rendered the relationship for the entire time period

1951-2011 into being non-existent. As the Indian economy started to become increasingly pro-business from the 1980s, the effect of education expenditure started to be felt as the human capital was put to better use. Moreover, as competition increased with increasing trade openness since 1991, companies were compelled to invest in innovation and thereby exploit the human resources more effectively. So, we see that primary, secondary and tertiary education expenditures influenced GDP growth positively since 1980 onwards.

6.2.2 Trade Openness and Growth

In Chapter 3, I also examine the relationship between trade openness and economic growth of India. Measures of both trade volume and trade barriers have been used as a proxy for openness. The Vector Autoregression results indicate that an increase in import penetration ratio and total trade share leads to an increase in GDP growth rate of India. The effect of trade volume on growth became significant from 1980 onwards when India gradually started to shift from a state-led growth model towards a market-oriented regime by undertaking various industrial reforms. I do not find evidence of any empirical relationship between trade barriers and growth. The problem can probably be attributed to data limitations and lack of accurate measures of trade barriers. There is actually some reverse causality from growth towards trade barriers (taxes on international trade as percentage of total revenue is the proxy for trade barriers used in this study). This may imply that as India is growing as a result of increasing its trade openness, its exports and imports are increasing and as a result the total taxes collected on trade are also rising.

The econometric analysis conducted in Chapter 4 shows that the effect of trade openness has been heterogeneous across sectors. Only the services sector seemed to have reaped the benefits of increasing openness, so far. I do not find any evidence of effects of trade on service sector growth when the estimation was conducted for the time period 1975-2010.However, the relationship became significant after 1991 which makes sense because

India started to adopt various economic liberalisation measures, particularly trade reforms, from 1991 onwards following the Balance of Payment (BOP) crisis.

No econometric evidence was found to claim that the agriculture sector benefitted from trade openness. It seems that agricultural sector performance in India still depends on the monsoon cycles because the explanatory variable, amount of rainfall per year, seems to be the only robust determinant of agricultural GDP growth. This hints towards the lack of public investment in the irrigation system of the country. The sector also seems to suffer from gross misallocation of resources. That is why, the variables such as agricultural capital formation and fertilizers have no significant growth effects.

At an aggregate or country level, I do not find any significant association between manufacturing performance and trade openness of India. But the picture of stagnancy of Indian manufacturing, which we see at the aggregate level in terms of manufacturing output growth, is not uniformly true at the state level. In Chapter 4.2, I therefore re-estimate this relationship using state level data. The major contribution of this exercise to the existing literature has been construction of trade openness indices for the major Indian states. Virtually no previous study has examined whether regional trade openness can explain some of the differences in the cross-state manufacturing experience. Overall, I find that there is a robust association between trade openness and manufacturing sector performance in Indian states. In line with the conventional view, trade barriers have a negative impact on manufacturing growth whereas trade volumes have a positive impact. The relationship was further tested for the manufacturing sub-sectors, namely registered and unregistered sectors, separately. It was observed that trade openness does not affect the performance of the registered manufacturing sector at all but has a strong positive impact on the growth of the unregistered sector. As far as the registered sector is concerned, three factors, broadly speaking, explain this lack of any relationship. Firstly, it is the ‘internal’ liberalisation of the

1980s, as opposed to the 'external' or trade liberalisation of the 1990s, which is mainly responsible for the productivity surge and accelerated output growth in the registered manufacturing sector. The 1980s reforms were more 'pro-business' in nature involving industrial de-licensing and deregulations compared to those undertaken in 1990s which were largely 'pro-market' involving increased integration with world markets through trade promotion. Secondly, the time lag of the effects of trade liberalisation has also been a question for vigorous debate. Some studies found evidence of a 'J curve' effect of the trade reforms on manufacturing performance. Being an inward-oriented regime for over four decades, trade liberalisation must have led to a structural transformation of the economy where many sub-sectors have been adversely affected owing to increasing globalisation. Consequently, many studies have found evidence of deceleration in productivity growth after 1991. Such a slowdown would occur both in sectors and sub-sectors far from the global technology frontier (for example, through obsolescence of product lines and skills) and in the aggregate in the initial stages of transition (for instance, diversion of human resource for learning about new technologies and markets). Once firms adjusted to the initial shock of higher competition from foreign imports through adoption of new skills and technology, the productivity growth rate picked up again in later years. Hence, it is not unlikely that studies examining the relationship between trade and registered manufacturing growth for the initial years of reforms did not find any significant relationship between the two. Moreover, the 1990s reforms programme was gradual in nature rather than that of a 'shock therapy' model, as carried out in some Latin American or East European economies and that can also be a reason why we do not observe any real-time positive effects (Panagariya, 2004; Bhaumik, 2008). Finally, stringent labour regulations are also held responsible for the failure of the registered sector in taking advantage of trade liberalisation. This is because, as an economy opens up, the sectors in which it has a comparative advantage expands and where it does not (maybe previously import-substituting sectors), shrinks. As a result, unemployment in the firms in the latter sectors rises and a restructuring takes place in the economy with workers moving into those sectors where the comparative advantage lies. However, this restructuring is probably hindered in the registered manufacturing sector of India due to rigid labour laws (particularly, the Industrial Disputes Act 1948). As a result, we do not see any impact of trade openness on the performance of this sector. On the other hand, the unregistered or informal manufacturing sector does not suffer from the problems of labour market rigidities because it is outside the jurisdiction of the industrial and labour regulations and, consequently, benefitted from increasing trade openness. Existing empirical evidence also suggests towards an indirect positive effect of trade reforms through increase in sub-contracting from the registered sector to the unregistered segment during the post-reform period as the registered firms looked to cut down production costs because of increasing competition from cheap foreign imports. Some studies also argue that increasing globalisation compelled many small firms to close down their operations. These firms were mostly in the unregistered sector and, as a result, average productivity in the sector went up with the elimination of the inefficient units during the post-reform period which eventually led to acceleration in the GSDP growth rate of the sector.

6.2.3 Determinants of Public Education Expenditure

Since the econometric evidence suggests that public education spending affects growth positively in the case of India so it can be claimed that, from a policy point of view, the government should allocate more funds towards education. However, if we look at the state level data, we see that education spending by the state governments varies significantly across Indian states. So, in the final exercise (Chapter 5.2), I attempt to ascertain the determinants of public education expenditure by state governments. Control variables in my econometric model include economic, political and demographic variables. The econometric findings indicate that richer states spend more compared to the poorer ones. Economic variables such as tax revenue and grants from the central government exert a positive impact on education expenditure. No significant evidence was found to suggest that political ideology of the ruling party affects education spending decisions in Indian states. Factors such as corruption can be hypothetically expected to lower public welfare spending in areas such as education and hence were included in the estimating model. A scatterplot analysis reveals a weak correlation between education spending and corruption. Bihar and Madhya Pradesh, who spend the lowest on education, are also among the most corrupt states. Conversely, the high performers like Kerala and Himachal Pradesh are the least corrupt states. However, econometric analysis does not find evidence in support of this correlation. There is a negative association between child population share (0-14 years, as percentage of total population) and education expenditure indicating that it is a disadvantage for the Indian young population to be part of a larger cohort.

6.3 Policy Implications

The finding, that public education expenditure having a significant impact on economic growth during the reforms period (post-1980 period), makes the case for continuation of government involvement in the education sector stronger. The study contributes to the existing public sector vs private sector debate in the context of Indian education sector in favour of the former. However, it is not to say in any way that private sector should not invest in education. The private sector should play a complementary role to that of the government because many studies have shown that private schools are more efficient in imparting learning than their counterpart. But, the government has to ensure access to education for those children who come from underprivileged households and cannot afford to pay the private school fees. Moreover, the fact that education spending started to affect growth since the undertaking of the economic reforms from 1980s onwards shows that education expenditure is a necessary but not sufficient condition for growth. If private sector is small and there is no competition in the domestic market then the economy suffers from high unemployment and rent-seeking activities. A major proportion of human capital gets involved in unproductive activities. Hence, the government should be carrying out widespread trade and other economic reforms to take the advantage of the human capital created by its education spending.

The econometric findings obtained in Chapter 5.2 have serious policy implications for the so-called 'laggard' states of India such as Uttar Pradesh, Bihar and Madhya Pradesh. These states have some of the lowest SDP per capita, highest levels of corruption and least spending on education per capita amongst all Indian states. On the other hand, the population of the richer states are slowly aging and the fastest growth in the working age population is going to take place in Uttar Pradesh, Bihar and Madhya Pradesh after Haryana over the next two decades. Given this scenario, it can probably be asserted that the future of India's demographic dividend looks grim. The governments in those states need to implement widespread reforms in the education sector to reap the benefits of this growing youth population.

The investigation of the trade-growth link in this thesis also leads us to some immediate policy recommendations. The aggregate level analysis demonstrates that trade openness has been beneficial for India's growth and the country should go for deeper reforms in this area. As far as agricultural sector is concerned, the lack of association with trade openness and overreliance on monsoon points towards the serious dearth of public investment in this sector as well as the gross misallocation of resources (attested by the lack of any effect of fertilizers on agricultural output growth in my model). Among others, the government should improve the infrastructure such as better access to irrigation facilities so that the sector becomes more efficient and competitive. The inability of the registered manufacturing sector in taking advantage of trade openness points towards the rigid and archaic labour laws in India. The government should undertake labour market reforms so that the necessary structural changes are allowed in the manufacturing sector in accordance with comparative advantage. This will enhance the overall productivity of the sector and eventually lead to faster growth.

6.4 Limitations of the thesis

The thesis suffers from some limitations that are data driven. The limitations are as follows.

i) Migration or brain drain affects the efficiency of education expenditure. For instance, if a country spends substantial proportion of its budget on education but a large proportion of the educated workforce migrates abroad owing to limited opportunities in the domestic market then the growth effects of the expenditure on education will be affected. Moreover, this is a major problem in the Indian context too. However, I could not control for migration in my econometric models owing to lack of yearly data on this variable.

ii) A more accurate picture of an empirical relationship between trade openness and manufacturing performance could have been captured in Chapter 4.2 if trade data for Indian states were available. In absence of any such data, I had to construct proxies for trade openness of Indian states using state-level industrial output data.

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